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AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

VOLUME XII FEBRUARY 12, 1923 NUMBER 4

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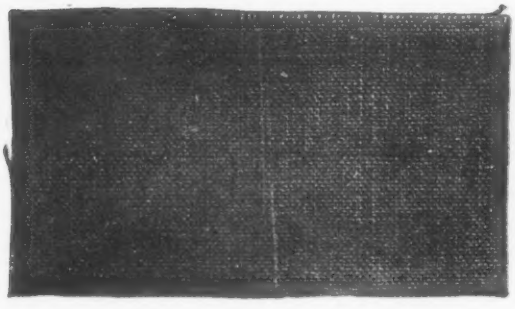

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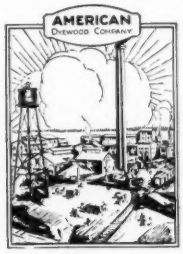

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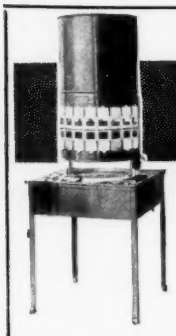

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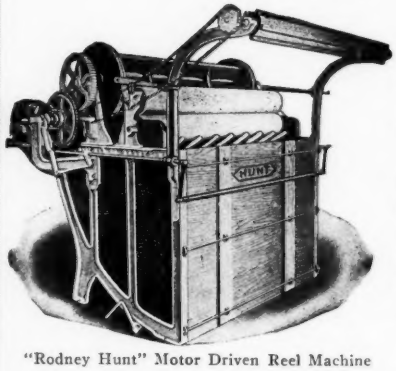

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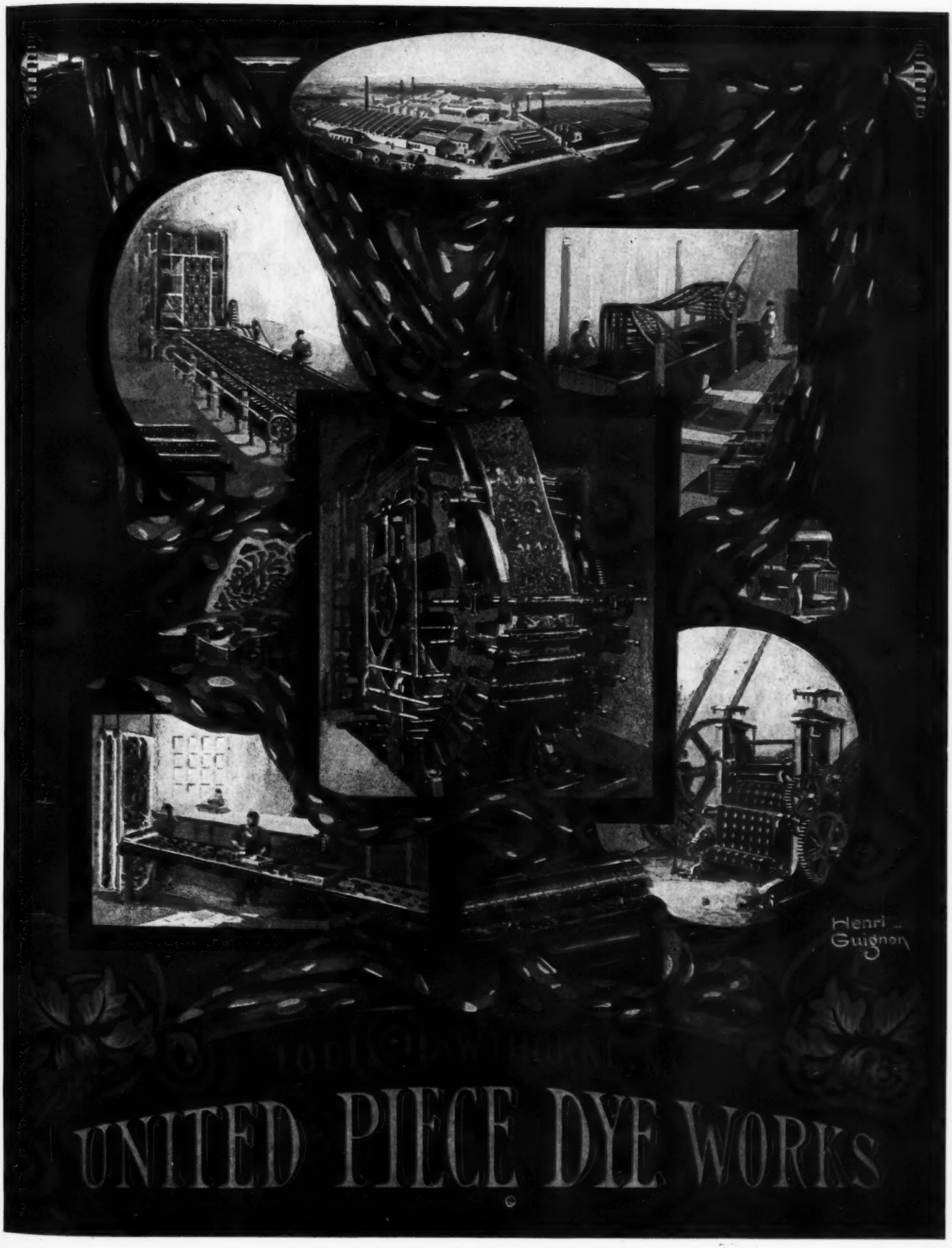
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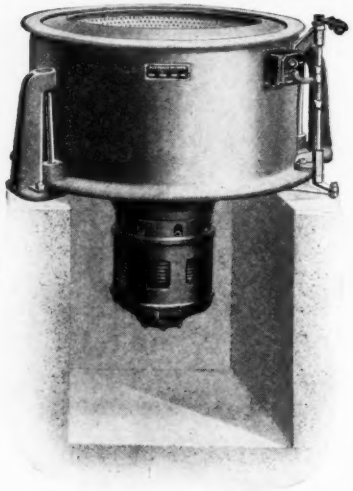

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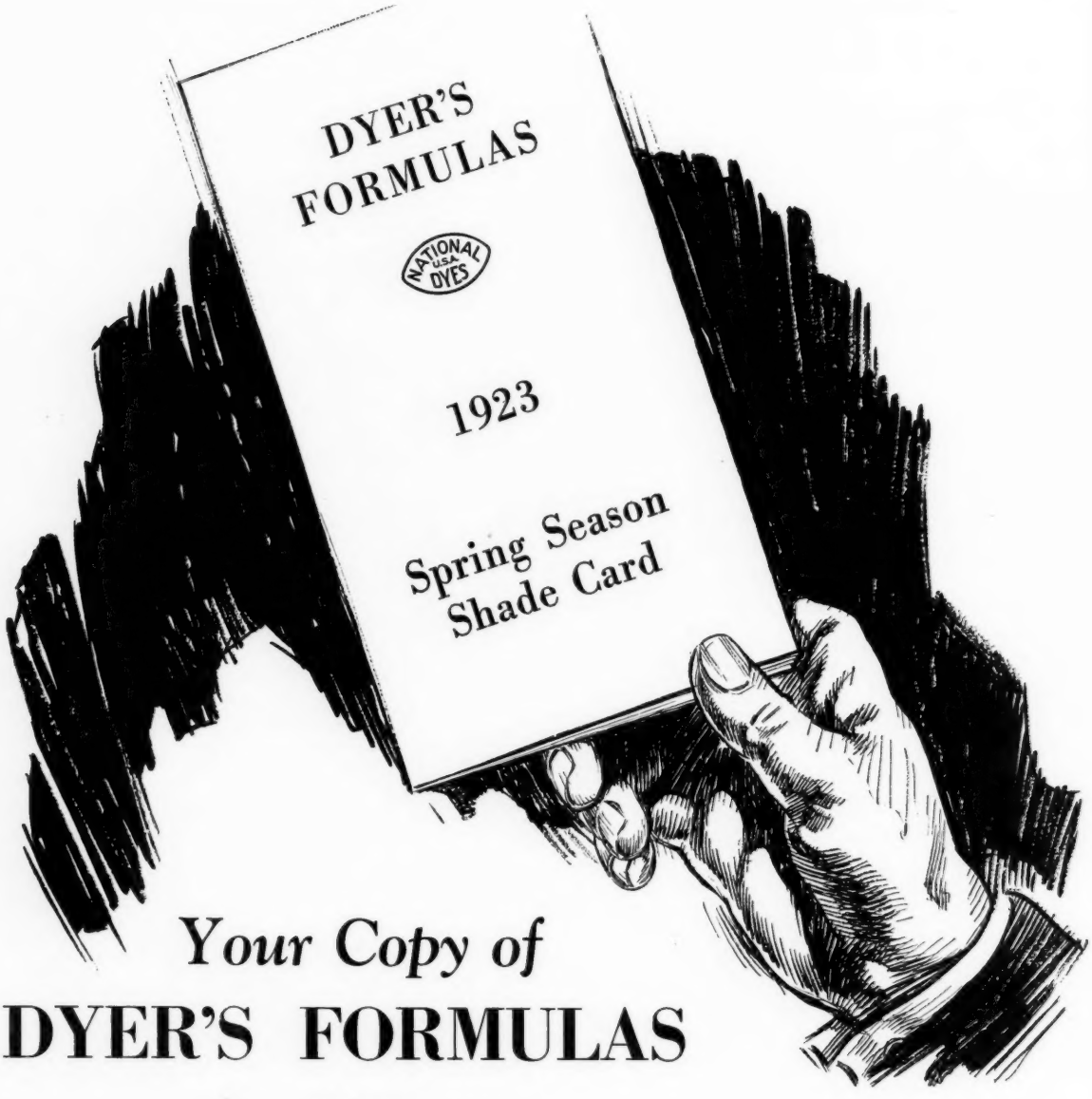

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VOLUME XII | NEW YORK, FEBRUARY 12, 1923 | NUMBER 4

Classifying and Measuring Color by the Ostwald Method

The Ostwald Color Theory—Primary Classification: The Dull Colors—What Is Black?—White?—The Bright Colors—Representing a Color by a Mathematical Formula—The Color Circle—Properties of the Color Circle—Supplementary Colors—Locating the Color in the Color Circle—The Prism Instrument—Measurement of White and Black—Principles Underlying the Method of Mensuration—Practical Method of Measuring Black and White Content—Example Showing How Measurement Is Carried Out

By H. T. TENEN

THE conception of color and our understanding of color change have undergone considerable alteration during the past few years, due to a new development which now tends to become of the greatest importance to the textile industry. Of course, everyone is interested in color. Nature is full of color and it is not strange that from earliest times Man has attempted to imitate Nature, first by painting his face and body with colored earths that he found in his searches, then by extracting colored juices and liquors from animal and vegetable life for coloring his fabrics, skins, the various structures that he built, etc., and finally by fabricating these natural dyestuffs with the aid of chemistry in synthetical processes, producing more beautiful, brilliant and pure colors than were ever dreamed of before.

But the textile manufacturer, the man whose livelihood is earned in the textile trade, the color matcher and the color mixer, the technologist in the textile mill where the dyeing or printing is carried out, have a far greater interest in color than the man in the street. They have had before them for many years the problems of matching colors, of handling thousands of different shades, of being forced to devise more or less makeshift systems of classification and methods of identification, so that one color might be distinguished from the other. They have had to measure in some way, however unscientific it might have been, the effects of light, washing with soap and water, perspiration, etc., on the dyed textiles. They have similarly had to devise means of securing new colors that possessed attractive shades that were fast to light and other influences.

Those textile men who have had to deal with colors know that the greatest difficulty in their classification and identification has been their number, and that it has been impossible to express degrees of change in color induced by light, etc., in a strictly scientific manner. Similarly, the matching and mixing of colors to secure a desired shade has been solely a matter of the eye. The more experienced and the more sensitive the eye color, the closer the match obtained. The personal equation has always been a prominent factor in such work.

The Ostwald Color Theory

The famous German chemist, Dr. Wilhelm Ostwald, who in past years had paid some attention to the purely theoretical side of color and color measurement, has recently devised a system both for classifying and measuring color which bids fair to become universally adopted wherever colors are dealt with. It is this system which will be described and whose practical application will be demonstrated in the present article. The new plan of classifying and measuring color is of the greatest importance to the textile man—in fact, to all who work with colors—for it affords the first means of measuring colors in mathematical terms and of classifying them as well according to a well-defined mathematical system. And in order to reassure those readers who may not be mathematically inclined, it should be said at the outset that the mathematics is of the simplest kind possible.

Primary Classification: The Dull Colors

Without going into any detailed explanation of the term color, it may be mentioned briefly that color is a manifestation of light. Without light there would be no color. Each body or substance has a characteristic color, in accordance with the manner in which it reacts to

the light that strikes it. Light itself is made up of the colors of the rainbow. When light strikes a body, it may be subjected to decomposition, to absorption and reflection so that it is entirely changed when it emerges from it again. The extent of the change that it undergoes determines the color of the body. For example, if all the colors of light, the red, green, blue, etc., are absorbed, with the exception of yellow, the color of the body will be yellow.

Ostwald divides all colors into two great classes, the first of which is composed of those known as the dull colors. Fundamentally, there are but two dull colors, black and white. By mixing these two in the proper proportions, an entire series of grays can be obtained. The gray series is unidimensional; that is, each color varies from the next in accordance with the amount of black or white it contains, and this is the sole manner in which any variation can take place. The series is continuous. It is always possible to form a third gray, intermediate between any two neighboring grays, by mixing together equal parts of the latter.

What Is Black?—and White?

In the aforementioned series the limits are black and white, one at either end. The black limit must be the blackest black and the white limit the whitest white. Practically speaking, there is no such thing as an absolute black or an absolute white, but some standards must be chosen to work with. An absolute white means that the substance whose color that is must return all the light that strikes it. If it absorbs or, literally, swallows a part of the light, then the color will have a grayish cast. It has been found that pure baryta white (blanc fixe, barium sulphate) is the nearest approximation to an absolute white, and this is taken as a standard reflecting 100 per cent of the light striking it. Compared with this standard, zinc white has a brightness of 95; that is, it reflects 95 per cent of the light that strikes it. At the other end of the series there is a black, which reflects zero per cent of the light cast upon it.

After the two limits have been fixed, it is an easy matter to make up a series of color cards containing various percentages of the two standard colors. These grays may vary from one another by any differential of black or white. It would be simple to make up a continuous series of 100 colors, each member of which contains 1 per cent less of white, starting with 100 per cent at the white end. After this has been done there will be obtained the means of classifying any dull color; that is, any gray. For example, in the examination of a chalk it may be found by comparison with the series of grays that the chalk color corresponds to a gray which reflects 80 per cent of the light and is marked 80. Therefore, gray 80 will immediately locate the color of the chalk. If a color is designated by the symbol "gray 4," then it is known that this color is almost a complete black, as it reflects only 4 per cent of the light, and it will be found near the black end of the series.

The Bright Colors

The other great sub-division of color consists of those classified as the bright colors. These are the colors that demand our particular attention, for they are one that textile men are interested in primarily. The bright colors are fundamentally the colors of the rainbow or spectrum, violet, blue, green, yellow, orange and red, and all the variations and shades that can be formed with them. The bright colors themselves are of three classes. First, there are the "color tones," which are the pure bright colors containing 100 per cent of the color without the admixture of black or white. Then there are the "clear-bright" colors, which contain the color tone and varying percentages of white. The "dark-bright" colors contain the pure color tone and differing proportions of black. Finally, there are the so-called "turbid" colors, which contain all three, pure color tone, black, and white. Most of the colors used in the practical dyeing and printing of textile fabrics belong to the latter class.

Representing a Color by a Mathematical Formula

Using these classifications as a basis, any color can be represented by a very simple mathematical equation or formula. If we use "w" to express the percentage of white in the color, "b" the percentage of black and "t" the percentage of color tone, then inasmuch as these percentages must add up to 100, any color may be symbolized by the equation, $w + b + t = 100$. If w is equal to zero, then there is obtained a dark-bright color containing only the color tone and black; if b is zero, then the color contains just white and the color tone (clear-bright color). Finally, if the color tone t is equal to zero, a dull color is obtained. It is thus evident that every kind of color is covered by this equation. In passing, it is desirable to call attention to one purely mathematical property of the equation which is made use of in color measurement—as will be explained later—namely, that only two variables need be known in order to determine the color, the third being found by subtraction from 100.

The Color Circle

In classifying the bright colors it is evident that a great deal of difficulty will be met. Ostwald, after giving the matter considerable thought, adopted the plan of arranging the pure color tones of the spectrum in a circle. He first selected six fundamental colors which were as pure as possible. For this purpose he used colloidal color lakes, which were made by dissolving the organic dyes in water and then mixing the solutions with lithopone and precipitating the lakes by the addition of tannin and tartar emetic for the basic dyes, and of barium chloride or lead nitrate for the acid dyes. The six colors used for this purpose were Sirius Yellow (Badische), to give bright yellow; Auramine O, to give dark yellow; Eosin A

(Badische), to give red; Rhodamine 3B (A. G.), to give purple; Brilliant Wool Blue FFR (Bayer), to give ultramarine blue, and Brilliant Acid Blue FG (Bayer), to give ice blue.

These colors were chosen because they give the purest shades and at the same time are most fast to light. It is not always possible to obtain these two properties in a single color; and, in fact, the purple and violet colors, while pure, are not particularly fast to light. But inasmuch as purity is the first consideration, it is necessary to put up with the tendency of the colors to fade on exposure to light. For this purpose the colors, or rather the color circle or color cards which are so formed that they can be arranged around a circumference, are kept constantly in the dark except when actually in use.

Properties of the Color Circle

The color circle contains one hundred colors. All of these are formed in accordance with standard specifications by mixing together the fundamental colors described above. The circle starts with bright yellow, which is designated by the symbol 00. Then a series of colors is made by mixing the proper proportions of Sirius Yellow and Auramine O. These are arranged in order around the circle, each member of the same bearing a numeral such as 01, 02, etc. Each of the six colors mentioned above has a particular place in the circle. The designations 00 to 24 correspond to color variations from yellow to red, 25 to 49 from red to ultramarine blue, 50 to 74 from ultramarine blue to blue green, and 75 to 99 from blue green to yellow again, completing the circle.

Supplementary Colors

The color circle is thus a continuous series of 100 colors, made up from the six fundamental colors in accordance with standard specifications and arranged in the order in which they are found in the spectrum. The color circle possesses one very important property which characterizes it not as the arbitrary arrangement that it appears, and which permits the determination of the position of any unknown color within the circle. Thus it affords a means of classifying colors and assigning them a factor which in itself tells where the color belongs in the classification.

This essential property of the Ostwald color circle is that at the ends of any diameter, terminating in any pair of colors, there will be found two shades that are exactly supplementary. That is, when equal quantities of these supplementary colors are mixed together, either by actual mechanical mixing or optically by painting equal portions of a disk with them and rotating the same rapidly, there will be obtained a neutral gray. The attainment of this neutral gray, when any two colors are mixed together in equal proportions, indicates that the colors are supplementary, that they are located at the extremities of a diameter of the color circle and that their numerical designations differ by 50. Thus if one of these colors is a yellow, 09, then the other will be 59.

It is a simple matter to find the supplementary color of a pure unknown color tone. It is only necessary to find the proper color in the color circle that will give a neutral gray with it. Then the unknown color is automatically located in the color circle. But as most colors contain black and white in addition to the color tone, it is necessary to resort to special means to determine the proper supplementary color in the color circle. It has been observed that it is possible to obtain a neutral gray in the regular manner with an impure color, a turbid color, by using a greater proportion of the standard supplementary color in the color circle than of the unknown color. The very fact that this has to be done indicates that the unknown color is not a pure color tone.

Locating the Color in the Color Circle

In the practical application of the Ostwald color theory, the first purpose of which is to enable the color technologist to classify and identify unknown colors with the aid of the color circle, it is necessary that the technical methods shall be as simple as possible, that they take little time to perform and that they involve the use of apparatus which is easily constructed and whose manipulation may readily be acquired by the ordinary laboratory worker. It is a remarkable feature of the Ostwald system of color classification and measurement, that, though the theory itself may appear to some a little complicated and involved, the apparatus that is used in the practical application of the theory is of the simplest kind possible.

The first task that the new color system must perform is the classification of colors by a method easy to understand and simple to carry out. For this purpose a standard color circle is used, or else a set of color cards, each bearing its proper designation and indicating its position in the color circle. One hundred color cards are required. The unknown color is located within the color circle by finding its supplementary color. As has been explained, mechanical or optical mixing may be employed. The time involved in mechanical mixing excludes that method from consideration. There are two general methods of optical mixing. One, the use of rotating colored disks, has been explained above. The other, which is more expedient for this purpose, consists in causing the images of the two colors, the unknown color and the supplementary color from the color circle, to blend into one.

The Prism Instrument

Just what is meant by the blending of images can be readily demonstrated by a simple experiment with the Lambert mirror. This is an upright sheet of glass fixed at the middle of a flat piece of board. If the two color cards are placed on either side of the glass and the apparatus is held away from the eye at the proper distance and angle, the two images will be seen to blend into one;

and if the two colors are supplementary, instead of seeing yellow and blue, for example, a neutral gray will be perceived.

While the use of such an instrument has its advantages over the rotating disk, still it is not easy and rapid enough to operate to render it feasible for use in a laboratory which has to examine many colors each day. Therefore the double refractive prism was utilized by Ostwald to produce blending of the two images into one. The double refractive prism, known as the Wollaston prism, is a crystal which gives two images of a single object, instead of just one as a glass mirror. When this crystal is held at a proper distance between the eye and a card coated equally with two colors, the colors will be seen to blend together to give a single image; and here again if the two colors are supplementary the net effect will be a neutral gray. On the other hand, if one color is purer than the other—that is, if the unknown color is not a pure color tone—then the blended image will no longer be colored a neutral gray, but will possess a mixed color, the predominate shade of which will be the color of the standard color tone which was selected as the possible supplementary color from the color circle. Thus, if the unknown color were blue and a yellow had been selected from the color circle as the possible supplementary color, then the mixed color would have a decided yellowish cast, the more so the less pure the unknown blue.

Inasmuch as most colors are impure—that is, contain black and white besides color tone—the examining instrument is provided with a special attachment for regulating the amount of light that passes through the Wollaston prism from either object. This is known as the Nichols prism. The instrument is made very simply. It consists of a flat stand which is provided with clasps for holding the color cards. A perpendicular hollow post is fastened to the stand. This post is provided with a set-screw, and the prism part of the apparatus, itself fastened to a vertical post of smaller diameter, can be raised and lowered by sliding the former into the hollow post. In an improved type of apparatus the entire examining apparatus is fastened to a cross-piece which may be raised and lowered just like the objective in a microscope.

The prisms are located in flat disks, the Wollaston prism in a lower disk and the Nichols prism in an upper disk. A graduated circle is used to determine the position of the movable Nichols prism with respect to the fixed lower Wollaston prism. A small eye-piece is provided in order to obtain a better image of the objects under examination.

The operation of the instrument is very simple. The unknown color, painted or printed or merely fastened to a card, if it is a small piece of fabric, is fastened to the stand and several standard colors from the color circle which are thought to approximate the supplementary color are arranged alongside it. A color card painted with a neutral gray is used for purposes of comparison. The height of the prisms above the stand is adjusted at the proper point and the colors are examined until the supplementary color is found. After that has been done, the location of the color in the color circle is determined as explained previously. If the unknown color is not a pure color tone, which has been determined by previous examination (this will be explained later), the Nichols prism is set at the proper point to compensate for the percentage of white and black in the unknown color, so that more light streams into the Wollaston prism from the standard color card. Then, if the proper supplementary color has been chosen a neutral gray will be obtained.

In examining the unknown color in accordance with the above method, the examination must be carried out under conditions of good daylight. This is defined to be bright sunlight from the hours of nine in the morning to three in the afternoon in winter and from seven in the morning till five in the afternoon in summer. It is, of course, quite understandable that different results will be obtained when the colors are examined under artificial light.

Measurement of White and Black

Under ordinary circumstances the measurement of the content of white and black in the turbid color is carried out after its location within the color circle has been determined. Black and white have already been defined not to be colors in the strict psychological sense of the word, but rather as physical properties of a surface which determine the amount of light that it reflects. Thus, no matter what the color of the surface, the more white it contains the greater the amount of light is reflected by it and the more black it contains the less the proportion of light reflected. Whether the light is strong or weak, artificial light or direct sunlight, the ratio of the amount of light striking the surface to that reflected by it will always be constant. This is perhaps the most important characteristic property of a colored surface or a color, and it makes possible the exact measurement of the black and white in a turbid color by the Ostwald method.

Hence, in measuring the black and white in a color, the capability of the color to reflect light is determined. This, as has been mentioned above, is independent of the intensity of the light under which the examination is conducted and of the position in which the eye is held. As far as the gray colors are concerned, the amount of light reflected by the color really determines the quality of the gray. The same is true when examining the bright colors. If, for example, the color is pure yellow, then it will absorb all the colors of light, as seen in the spectrum, with the exception of the yellow. As is understood, the colors in the spectrum correspond to certain definite wave lengths of light. If the yellow throws back a greater number of wave lengths than it should if it were a perfectly pure yellow, then it assumes a yellowish white cast. On the other hand, if the requisite amount of wave lengths is not reflected, then the yellow assumes a grayish to black cast. Thus, the purity of the color is determined

by the amount of light that is reflected by it. If this is greater than what corresponds to the standard yellow color tone the yellow contains some white, and if it is less it contains some black in addition.

Principles Underlying the Method of Mensuration

It may be assumed that the unknown color is painted or printed on a piece of white cardboard. If an ordinary spectrum is thrown on the paper and the color is drawn through the spectrum so that it is observed through the various colors of the same, then certain peculiar effects will be perceived. It will be noticed that the unknown color—call it yellow—will appear to be brightest at a certain point in the spectrum and dullest at another point. The unknown yellow will be brightest at the point when it is observed through the yellow color of the spectrum. It will be dullest when observed through that blue part of the spectrum which contains the unknown yellow's supplementary color.

If the unknown yellow were a pure color tone, then when it was observed through its corresponding yellow in the spectrum it would have appeared as a pure white, the color of blanc fixe. On the other hand, under the same supposition, at the dullest point—that is, at the point where the color was observed through its corresponding supplementary color in the spectrum—the color would have appeared as a deep black. These effects were not attained for the reason already mentioned; viz., that pure color tones are few and far between. Hence, at the brightest point a certain proportion of light is absorbed, and at the dullest point a certain part is reflected.

Therefore, the unknown yellow may be considered as being constituted of three parts, the pure color tone t, the white portion w, and the black portion b. The sum of these three factors is equal to 100 per cent. At the brightest point in the spectrum the unknown yellow reflects as much light as it possibly can. The brightness of the color is partially dependent on the amount of white in it, and it also depends on its content of the pure color tone, yellow. For when viewed through the yellow of the spectrum, its brightness is determined by the homogeneous yellow light that it reflects. Hence, if this brightness is designated by h_1, then h_1 will be equal to the sum of w and t. As this brightness is less than unity, which may be taken as the brightness of blanc fixe, and as $w + t + b = 100$, we have that $1 - h_1 = b$.

Moreover, when the unknown color is observed through the blue part of the spectrum, at which it appears dullest, then any light that is reflected by the unknown yellow under these conditions is due to the white that is contained in it. The black reflects no light and the yellow is neutralized and entirely absorbed by the supplementary blue. Hence, if this brightness is called h_2, it may be set equal to w; and as $w + b + t = 100$, the factor t is equal to the difference between h_1 and h_2. It is, of course, evident that it is only necessary to find the percentages of white and black in the unknown yellow in order to determine all of its three constituents.

Practical Method of Measuring Black and White Content

In practical work it is not feasible for many reasons to use the spectrum as described above. In the place of the spectrum light filters are utilized. These filters are colored with pure color tones and allow only a pure homogeneous light to stream through them. The measurement of colors with the aid of these light filters is convenient to carry out and gives very accurate results. The filters are made from sheets of colored gelatine, which are fastened to a plate by means of Canada balsam. These filters are numbered, there being five in all. They are colored yellow, red, blue, sea green and grass green. Each filter is designated for use with certain colors of the color circle. For example, the colors from 18 to 35, comprising a series of yellows and reds, are examined under the sea-green light filter.

The filters are made so that they can be inserted in the examining instrument, which is of the same type as described above. In fact, a universal device is used which enables the experimenter to remove the apparatus used for locating the color within the color circle and substituting the light filters which are used for determining the black and white content in the color. In its essential parts the instrument consists of a stand and an upright post fixed thereto, which is made in such form that the examining apparatus can be easily fastened to it and moved up and down, varying the distance between the eye-piece and the base to suit.

There are two types of light filters, the graduated filter and the shutter filter. The former is used in the determination of the percentage of white in the unknown color. This is examined through the filter and compared with a series of standard grays until a proper match is obtained. The number of the gray will then indicate the percentage of white in the unknown color. The percentage of black is found by examining the unknown color through the shutter-filter and comparing the gray seen through it with a series of standard grays. When a match is obtained, the number of the gray subtracted from unity will give the percentage of black in the unknown color. The sum of the two subtracted from 100 per cent gives the percentage of color tone.

Example Showing How Measurement Is Carried Out

Suppose an unknown yellow is being examined. The first step would be to determine whether it was a pure color tone, which could be done by attempting to find its supplementary color from the color circle by the use of the Wollaston prism instrument. If it were found impossible to find this supplementary color with the Nichols prism wide open, then by adjusting the position of the

latter to shut out some of the light from the color it will be found that the unknown color is impure. If it has been determined that the color is impure, the next step is to find out how much black and white it contains.

First, the percentage of white is found by examining the unknown yellow through the sea-green colored light filter. The gray, seen through the filter, is compared with a series of standard grays until a match is obtained. Suppose this standard gray is marked 75, then the percentage of white in the unknown yellow is 75 per cent. The next step will be to examine it through the shutter-filter. On comparison with a series of standard grays, the color observed is seen to match with gray 90. This indicates that the black contained in the unknown color is 10 per cent. The sum of the black and white is equal to 85 per cent, which leaves the pure color tone, yellow, 15 per cent.

Now, if the unknown yellow is examined through the Wollaston prism instrument, so that the Nichols prism attachment is adjusted to shut off 85 per cent of the light from it, the standard blue in the color circle, which is the exact supplementary color of the unknown yellow, may be easily determined. If this is found to have the designation 55, then the yellow—that is, the 15 per cent pure yellow tone in the unknown yellow—has the position 05 in the color circle. The complete designation of the color is then 05-15t-10b-75w.

This color can be built up directly from the standard 05 yellow, pure white (blanc fixe) and absolute black. The matching of the colors is therefore reduced to a mathematical procedure. Furthermore, if colors are being examined for their fastness to light, the effect of the light in destroying the color tone can be ascertained and expressed in mathematical terms by determining the percentages color tone in the dye, before and after exposure to light, by the above method.

From the Journal of a Hoisery Dyer

By S. P. R.

[*Note—The following consists of extracts from a diary which has come into our possession. We believe the subject matter selected for publication to be interesting and, as a secondary consideration of course, not a little entertaining. Further extracts will be given at irregular intervals in future.—Ed.*]

JANUARY 5.—Since I took this new job I have been too busy to write up anything till to-day. What a mess that fellow left for me to straighten out, and how do they ever expect me to use up the colors he has in that drug room? There's anything from a pound tin to a barrel of every shade anybody ever thought of putting on stockings, and every one from the XXX Co., as if nobody sold dyes but them. Every one is a mixture and about three kinds for each shade according to what the goods are made of. One of the kettle hands told me he lost his job because the boss wanted some new shades and wouldn't let him order any more dye because he had a couple of tons in the place now, and if he was any kind of a dyer he ought to be able to use what he had. I see my troubles ahead trying to use up those mixtures and holding my job.

January 15.—I just got a big lot of samples from the XXX Co. I had them make me dyeings of every package they had put in here. I suppose they thought I would keep on passing them the orders, but I have had trouble enough since I came here. I haven't dared try to dye anything but cordovan and Sulphur Black on the all-cotton goods, and I see no wthat the cordovan for half silk isn't a bit like our shade and the fancies are awful. The cotton and silk don't come within a mile of matching each other.

January 16.—I showed the samples dyeings to the boss and it took me an hour to bring him around so he is going to let me get some dyes of my own, just enough so I can use up the junk that's in the drug room.

January 17.—Went down to Philly to-day and got a stack of sample cards from everybody in the business. Ordered five new colors so I could use up the old stuff, but I split the business among three of them and the XXX Co. wasn't among them, either.

March 16.—The last of the old stuff is gone and I can start to-morrow with a clean slate and get the output up to where they want it inside of a week. XXX's salesman was around to the house this evening, but the wife told him I had gone to a lodge meeting.

March 19.—The old cordovan was a mean color in some ways. You never could tell how it was going to turn out. When it was damp it was red and then it dried into an olive on the forms, and when it was laid out for pairing it began to get redder and didn't stop getting red for nearly a week. Then it began to go flat again. It did that because it had ordinary Direct Black and Benzopurpurine in it. I make mine now with a faster black and use a lot of a very red brown that is pretty fast and sometimes I use Violet N with the yellow brown and fast black; they never change and they wash and wear a lot better, too.

March 30.—The two new Monel metal rotary machines are set up now and we gave them the first run to-day. They are the only thing for fancies. It's no use trying to boil out a wood machine so as to dye a nude or a pearl and get it right. I am using all straight colors for my shades, and make sure that the light shades are all level

(*Concluded on page* 149.)

Disputes in Relation to Textile Fabrics

(*Continued from page* 90.)

Shortsighted Selfishness—Bad Advice—Faults in Fabrics—Textile Perfection Impossible—Faults Crop Up Late—Carding—Weaving Faults—Dyeing and Finishing Faults—Disputes—Legal Decisions—Conference—Procedure—Matters Which May Be Referred to Arbitrators—Submission and Its Importance—Time Limit—The Award and Cost of Proceedings

By A. MITCHELL BELL

A paper read to the Halifax branch of the Foremen Dyers' Guild on March 7, 1922. *Copyright of the Guild*

Printed in the Dyer and Calico Printer

Bad Advice

One may safely say that many of the very troublesome and unpleasant endings in disputes between business firms has been accentuated by erroneous advice and decisions given by persons who have not been as thoroughly acquainted with what was supposed to be their own particular work as they should be, and which one could reasonably expect of them to be; therefore it is essential that all persons who hold responsible positions, and especially those who by the nature of their standing in any business are called upon to give decisions, should thoroughly understand from A to Z their own particular work, however important or otherwise, and in addition try to learn something of the preceding and succeeding operations sufficiently to enable them to reasonably appreciate, or be able to reject, any plaintive or defensive proposals put forward by others from their respective departments or sections.

The one who seeks to fit himself in such a manner makes himself into a most valuable servant, and is truly an asset to his firm, as well as making it possible for him to derive the highest pleasure obtainable from his daily business, which is of inestimable value to himself. And one is of the opinion that such men in the majority of cases will ultimately receive the recognition from their employers that they would certainly deserve.

Faults in Fabrics

It will not be out of place here to make a few observations in regard to faults in fabrics and their respective causes. It is to be regretted that faults and their causes are legion and innumerable, and cannot be otherwise under our present regime. This is easily understood and quite obvious when it is remembered that the material of which fabrics are composed have such a multifarious diversity of processes to pass through, which are both mechanical and chemical, and produce changes that are entirely different in the finished product to that of the raw material or materials which were originally commenced with.

Defects in fabrics can be produced in one or more of the following sections of operations: (a) Wrong selection of raw materials; (b) faulty blending and inadequate mixing of raw materials; (c) faulty scouring and drying of loose wools, etc.; (d) preparatory processes in the making of the materials into yarn; (e) carding, drawing and spinning of the yarn; (f) warping, beaming and dressing of warps; (g) looming of warps, slaying of warps, wrong drafting, etc.; (h) weaving; (j) scouring, dyeing and finishing.

In addition to this list of sectional operations there are other faults which cannot be so easily coped with, viz., those that are of an accidental character or due to ignorance, indifference, or negligence on the part of the operative.

One of the most instructive and helpful studies that any student of textile science and technology can take up is that of defects in fabrics, their causes and remedies; and although sometimes it may cause a feeling of depression and occasionally of disgust, yet it is nevertheless interesting, and at times most enjoyable. That which causes depression and gives pain to the investigator is the knowledge of the monetary value of the goods that may be involved and the loss sustained by one or more of the parties concerned.

Textile Perfection Impossible

It has often, in the trade as well as in public, been stated that there has never been made yet a perfect piece. It certainly appears to be a bold and apparently a bad statement to make; but, after all, most people with wide and long experience are compelled to admit that it is a correct one, because however careful one may have been in the selection of raw materials, in reducing them to a yarn formation, weaving them into a piece or fabric, and putting the finishing touches upon it to enhance its beauty and value, there always remain, to a greater or lesser degree, faults that seem to be inevitable.

During a discussion after a lecture given under the auspices of the Bradford Textile Society during last winter on the subject of faults in yarns and fabrics, I suggested and recommended the creation of a committee consisting of members from all the branches of the textile trade, with the specific object of fixing a standard or standards that could be accepted throughout those trades,

that would be reasonable to expect in fabrics, etc., and that should be accepted by all when those standards had been reached in the goods, in whatever form when delivered, and especially when they have been delivered in the best form possible. This is most important, and would be a most valuable thing in the trade; because it is most annoying, and even exasperating, when one has taken every care in the production of goods, and when they are most reasonably perfect, to have them rejected by those who have too high a standard of perfection or who cannot recognize it when they have a reasonable perfection in the goods delivered against an order given by them.

Faults Crop Up Late

The unfortunate part in connection with this work is that many of the faults created in the early stages of the yarn and fabric production do not appear until they have passed through the finishing operations and, although they are present in the materials, yarns and fabrics, seem to lie dormant until the final product is finished; but on being passed over the finisher's perch, or before the passer in the merchant's top room, many of them come very much into evidence, and the trouble commences, which necessitates a working backward to find the real cause of the defects.

In both woolen and worsted fabrics we have examples of this nature, and when these do occur it is an unwise procedure for those who are connected with them and concerned in the ultimate result of the case to be too hasty in jumping to conclusions, but rather to be ready to permit of a thorough investigation into each individual case, as both sides are likely to benefit to a greater or lesser degree in the ultimate result.

One of the results of the wrong selection of raw materials and improper mixing of those materials is what is known as cockled or crimpy pieces. When mixing materials that possess varying degrees of felting properties, unless great care is exercised in the very early stages of the yarn production, this is a most natural result, and the advice one can give here is to see that no operation be omitted that will assist in obtaining the best results, even though it may be an *apparent* economical advantage, because the advantage gained here is lost in a much greater degree when the goods are finished and have to either be jobbed or sold at a reduced rate and afterward debited to the person who should happen to be the defaulter.

When the material has been wrongly selected, the one responsible for its selection is the one upon whom the blame must rest, and is quite easy to locate; but in the second case this is not quite so easy to locate. In the making of certain types of woolen goods, faults of this kind are caused in the willying room, and one or two causes may be here enumerated.

For example, suppose a blend is being formed of a good clothing wool, along with wool of a coarser nature having a decent length of staple, the blend being intended for the purpose of producing a fabric having a raised pile chiefly produced with the coarser and lustrous fibers. Unless these materials are thoroughly mixed in their loose state, and before the yarn stage is arrived at, there will be no alternative result but that of a crimpy piece when finished, and this may easily make it an unsalable cloth.

Carding

Too much reliance is put upon the carding operation to rectify any error of this kind; and although it is readily admitted that by its operation the evil is much reduced, still its influence in many cases is not sufficient to eliminate entirely the possibility of this fault appearing in the goods when made from the blend in which these materials have been used.

In the department mentioned there are two ways in which this may be caused; and although they may by some be thought to be trivial, they are nevertheless of sufficient importance as to be worthy of our giving to them proper attention. A pile of wool is made up of horizontal layers of the different qualities or "runs." It must be fed to the machine by using the fork properly. The two improper methods are: (a) Taking it in armfuls instead of using the fork first; (b) after using the fork properly, the non-use of the exit tubes on the willying machine.

Faulty carding in the case of woolens, in the form of neps, etc., cannot be eliminated altogether, but are finally produced in the spun yarn. Also in the worsted yarn production the faults that are produced in the gilling and drawing are not eradicated but are found in the yarn when it has reached the final process of spinning.

What has been said in regard to woolen yarns when mixing two different qualities of materials together may also be given here in connection with worsted; and where this is necessary to be done to obtain a yarn of a certain quality, or to produce a special effect in a piece of cloth, the producer of the yarn will be well advised to pay particular attention to the very early processes in his department when the actual mixing takes place, because the one who does not do this is really asking for trouble at a later stage when the costs of the material he has produced have become relatively greater.

Defects produced in the process of warping, beaming and dressing are, as a rule, fairly easy to detect, and do not present much difficulty in the location of the cause, as these defects appear longitudinally in the piece or pieces made from the warp, and some of them appear every section width. These are chiefly due to the ridges formed when making the warp and their non-distribution when being run from the mill onto the beam. On some of the older types of machines this method of distribution is essential and must always be done when the warp is being put on to the beam ready for the loom. Other defects that may appear are due to the difference in tension

(*Continued on page* 147.)

Proceedings of the American Association of Textile Chemists and Colorists

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JANUARY MEETING OF NEW YORK SECTION*

The January meeting of the New York Section of the American Association of Textile Chemists and Colorists convened at 8.15 p. m. Friday, January 26, in Exhibit Room No. 1, Hotel Pennsylvania, P. J. Wood presiding.

After the routine business of the Section meeting, L. J. Buttolph presented a paper on "The Mercury Arc Test of Color Fastness to Light," as follows:

THE MERCURY ARC TEST OF COLOR FASTNESS TO LIGHT

By L. J. BUTTOLPH
Cooper Hewitt Electric Company, Hoboken, N. J.

I come before you as a physicist and engineer rather than as a textile chemist or colorist, and to discuss a specific line of development rather than the general principles underlying your fundamentally difficult problem of the standardization of methods of testing the light fastness of dyed materials. Much has been said of the limitations of present methods, and in this regard I shall assume that you are familiar with the comprehensive report of your subcommittee on fastness to light.

As representing the Cooper Hewitt Electric Company, under whose patents all domestic mercury arc lamps are made, I shall detail progress to date on a development which we hope may contribute something to the solution of your problem.

The mercury arc in quartz glass has been on the market for some fifteen years in forms designed primarily for industrial lighting and for the sterilization of water. The mercury arc in this form has been used from time to time for the laboratory testing of fastness to light and a relatively large number are still in active service for this purpose. Their very unique characteristics of great speed and relatively low operating cost have kept them a live issue in spite of the apparently grave inconsistencies which arise and with which many of you are very familiar. In a problem involving so many factors and so indeterminate a human equation the development laboratory must finally get much of its data from actual practice in the industrial field. To standardize the mechanical operating features of the mercury arc for this purpose a special apparatus has been developed and is exhibited here to-night in its most complicated form; that is, equipped with a rectifier for operation on alternating current.

A vertical mercury arc is used and is itself always operated on direct current thus avoiding the well-known difference in radiation distribution between alternating and direct current arcs of the solid electrode type. The arc housing is designed to give uniform ventilation of all test samples with a minimum

**The Proceedings of this meeting were reported verbatim by the Master Reporting Service, New York City. Remarks by Dr. O. R. Flynn were omitted at his request.*

of circulation near the arc to minimize the formation of ozone and nitric-oxide. The sample holders are symmetrically distributed about the arc so as to receive the same intensity of radiation in all positions. Provision is made for three exposure areas for each sample, thus permitting three exposure times without changing the sample. Twenty of these holders are supplied, and in routine work it is practical to expose as many as sixty samples at one time. These sample holders are provided with a unique feature in the elimination of the "contrast effect" in the comparison of adjacent test areas faded different degrees. This is accomplished by insuring a narrow line of unfaded material between successive test areas. The sample holders provide for the easy use of ray filters between the arc and the sample, an important feature to which I shall refer later. The radiation space is completely screened so that the operator is never exposed to the direct radiation. In many cases it is desirable to examine exposed samples for fluorescence, changes being evident in that way before they are visible to the eye, and an ultra-violet filter is built into the arc housing for this purpose. A volt meter indicates the condition of the supply voltage as well as the voltage of the arc. The general convenience and portability are obvious.

Illustration of Uviarc Cabinet Exhibited by Mr. Buttolph in Connection with His Paper

Your committee has pointed out that there are two alternatives, a standard lamp of constant and reproduceable characteristics similar to those of sunlight, or a standard method of measuring and recording in terms of sunlight the total effect of any light source. Experience in analogous lines of development points to the use of standard radiation sources in connection with secondary standards for routine use, and thus in photometric practice the highest intensity large size incandescent lamps are not in themselves satisfactory as reference standards, but have great advantages as secondary standards in the photometry of other large high intensity lamps.

I suggest the mercury arc, properly used, as a very satisfactory secondary standard having two prime requisites for industrial use—speed and low operating cost. Before detailing its advantages for this use, a word may not be amiss as to the eventual primary standard.

Because of the great difficulty in calibrating such a standard in terms of so variable a thing as the color fading effect of sunlight it is obvious that the standard must be constant and reproduceable without the necessity of repeated comparisons with sunlight. It is very obvious that such a standard must also emit radiation of shorter wave length than that transmitted by the glass used in ordinary incandescent glass bulb or arc lamp globes. A glass similar to Uviol or to fused quartz must be used. The radiation, particularly the violet and ultra-violet parts, should have the same energy distribution as sunlight, a factor determined in the artificial lamp by the nature of the filament or the arc electrode material and by the enclosing glass container. It is certain that in a reference standard the quality of the radiation is more important than the intensity and that cost is not vitally important.

Of all artificial light sources the high intensity tungsten lamp is undoubtedly more nearly like direct sunlight than any other. Two things have prevented its use in fastness testing—its availability only in small sizes (1,000 watts) as compared with the carbon arc (4,000 watts), and the necessary use of a glass globe absorbing a range of some 200 Angstrom units of very effective radiation emitted by the filament and present in direct sunlight. It is probably only a matter of a short time until incandescent lamps of two or three kilowatt capacity will be available, and such a lamp in a quartz glass bulb would, I believe, be a satisfactory reference standard. Data have been recently published on the radiation characteristics of a tungsten mercury arc and such an arc might satisfactorily combine speed with approximation to sunlight. Development along these lines is going forward so rapidly that your Association could very well wait a year or two for greater possibilities before settling upon a reference standard.

It has been the universal experience that, while the high intensity, unmodified radiation from the quartz mercury arc generally gives results very comparable with those obtained with sunlight, there are also many cases of strikingly abnormal effects. These effects have been shown by experience to be associated with the presence in the mercury arc radiation of wave lengths much shorter than are in direct sunlight. Thus it is that we find it possible, where necessary, to eliminate the possibility of abnormal effects by the use of a ray filter to absorb the radiation not ordinarily present in sunlight. We know that this can be accomplished by the use of thin sheets of ordinary crown glass. We believe that it will be possible to secure the same practical effects at less sacrifice of speed by using filters of greater transmission.

The accumulation of sufficient data upon which to base reliable exposure factors requires some time, as you will appreciate. We expect, however, to be able to specify a certain exposure to the direct unmodified radiation of the mercury arc such that any but what may be called perfectly light fast dyes will be faded. This elimination test will involve a few hours of time. The few colors which are faded by this preliminary test are, however, to be given another chance by an exposure behind ray filters whose factors the operator will know. This test, while slower than the direct one, will be practically identical with sunlight so far as we have been able thus far to determine. When used in this manner the mercury arc makes available for routine factory control a rapid approximate test which experience has shown may be used for any but the most exacting work. By the addition of filters there will also be available a slower but still inexpensive test which will for all practical purposes duplicate the action of sunlight. There remains to be investigated the question as to whether there are actually any effects which can be definitely attributed to traces of ozone or nitric-oxide formed in the neighborhood of the mercury arc. Such effects have been often referred to in the literature, but there is considerable evidence to indicate that ozone has received the blame for effects which the observers have not been able to otherwise account for.

A much more definite and tangible effect of importance in all tests of light fastness regardless of the light source is the effect of humidity. In Mr. Gordon's article very great and striking differences in New Jersey sunlight as compared with Arizona sunlight are attributed very largely to humidity. There are good reasons in chemical theory as to why such might be the cause, but before making too sweeping assumptions we must separate from the humidity effect the effect of the acid fumes for which the New Jersey meadows are famous.

In so far as it will always be necessary to express fastness in terms of resistance to exposures for certain lengths of time to a certain intensity of radiation there will always be involved in the definition of light fastness a unit of radiation intensity. It is obvious that there is no way of defining such a unit in terms of sunlight, and I believe that eventually the unit will be some special form of high efficiency incandescent lamp whose radiation characteristic has been determined in terms of average sunlight by some such authoritative body as the Bureau of Standards. Once this part of the standardization has been accomplished it should thereafter be possible to specify light fastness in terms of reciprocal of the time of exposure to such a reference standard, or in terms of the reciprocal of the number of sun hours required to produce a first perceptible change in color.

The following informal discussion followed the presentation of Mr. Buttolph's paper:

Question—Will this be used on A-C current?

Mr. Buttolph—By the use of a rectifier.

This is a little Cooper Hewitt rectifier, such as they used to use in the garages.

Mr. Hermann—Is there any reason to believe that the difference in temperature between a bare mercury bulb and one that is specially shielded will not also be reflected in the difference between the shielded mercury bulb and the sample? Will the fabric not also have that higher temperature, due to the radiance that you are shielding the thermometer from?

You say that a temperature reading, because of the radiant energy, is different due to direct exposure. Well, isn't the same thing true of a sample that is directly exposed?

Mr. Buttolph—Not rigorously, because you have in the case of all ordinary rough, loose texture materials an entirely different reradiation characteristic than you have from the mercury in a thermometer bulb.

Mr. Mailey—The actual temperature measurements are made in the middle of the textile, is the statement that Mr. Buttolph made, and that is really the answer to your question: that the average temperature of the textile is around 50 deg. Cent.

Mr. Hermann—But fading proceeds on the surface, not in the middle. And, furthermore, we know that fabrics, especially if they are dark colored, absorb heat and don't reflect it; therefore, the temperature would be higher, and that would be characteristic of a radiant surface such as a mercury thermometer. It reflects, and it is never as hot as a dark surface.

Mr. Buttolph—Of course, that is a question involving the fundamentals of radiation. I would be a little inclined to question that general statement that in an area of uniform heat the polished thermometer bulb will be at a lower temperature itself than the surrounding area because it reflects. There is exactly parallel with its higher reflectivity a correspondingly lower emissivity—so the two things counteract each other. It isn't as though the thermometer bulb itself were a source of heat.

However, as a matter of practice there is a thing, of course, that we, I confess, don't know a great deal about, and that is how the temperature involved in a test cabinet of this kind, or any other test device you use, compares with the temperatures involved in ironing your materials. Of course, here you have a high temperature associated with photochemical changes, and it is conceivable that the temperature will accelerate the photochemical changes in the sense that ordinary heat from a flat iron would not.

Mr. Jones—Still, that temperature is no higher than that of direct sunlight under extreme conditions. By direct sun you get 115 or 116 degrees.

Mr. Wilmot—What is the average life of the quartz bulb in the lamp?

Mr. Buttolph—I can only answer that in this indirect way: that a horizontal type of lamp of the same capacity as this, and of the same general dimensions, operates in water sterilizers under more rigorous conditions; it is an unsymmetrical burner, so we would expect the tax on it to be greater; and a water sterilizer, in fact, has to give eight months of continuous operation, or the R. U. V. Company, who handle the outfits, will, I believe, lose money on the proposition.

Mr. Wilmot—What is the cost of replacement of one of these bulbs?

Mr. Buttolph—I don't know.

Mr. Firchock—The vertical type is $100.

Mr. Wilmot—In other words, it would cost $100 every year or eighteen months to replace the bulb?

Mr. Buttolph—It would be rather unusual that you should require continuous operation; say, even three-quarters of a year. You see, that is a great deal, as laboratory service goes. You realize that you yourself only work a third of that time. This thing, as ordinarily used, would not call for twenty-four-hour operation; it would make all ordinary, approximate tests within less than a working day. That is where the advantage of its speed comes in.

Mr. Hermann—Have you worked out any comparison with sunlight; any ratio?

Mr. Buttolph—Yes, we have some ratios, but we have not published them yet. Some of the men here, I think, have worked on some of those ratios; do you know what they are?

Dr. Flynn—I have carried on some tests. Two and four-tenths is the ratio I got under crown glass.

Mr. Buttolph—That was working with what we call "laboratory outfit." That is a horizontal burner of the same radiation characteristic as this. That is through crown glass filters, and directly?

Dr. Flynn—Why, of course, directly—that is, eighty or ninety times as fast as sunlight.

Mr. Gordon—Have you any data on the rate at which this lamp loses its efficiency, with the time in which it is used?

Mr. Buttolph—The very well-known data by the Bureau of Standards. We have made a large number of tests and are making them now—routine radiometric tests—by exactly the same method that Dr. Coblentz used, and in general we are not getting quite as great depreciations; but, then, they are of the order of 40 or 50 per cent in the extreme ultra-violet. But the significant thing in that connection is this: that as we suggest the outfit to be used for any sort of exacting work with crown glass, or a rough equivalent, filter, your depreciation will come out in the radiation which that crown glass absorbs. There is that thing to keep in mind in connection with the depreciations of a quartz lamp: that it is not a general lowering of the level of intensity through the whole spectrum, but it is a cutting off of the short wave lengths. Do you see?

If you can visualize it in terms of a spectrum spread out on a chart, there are two ways that the total amount of energy there might depreciate: you might have a uniform depreciation, we will say, of 10 per cent of all different colors, or you might simply chop off 10 per cent of the total radiation by cutting out entirely all of the short wave lengths. Well, now, that is of the nature of the depreciation. The shorter the wave length, why, the greater the absorption by any deposit on the glass or any crystallization or change in the constitution of the quartz.

Mr. Gordon—In ordinary tests you would advise using the arc without the crown glass filters?

Mr. Buttolph—Yes.

Mr. Gordon—In that event, it would show a very great change.

Mr. Buttolph—The test we propose there is of this nature: You have, we will say, what we call a very fast dye, and we have some that we have been running for months in sunlight and there is no appreciable change at all. Well, now, if you have a dye of that nature the question of the length of exposure loses its significance, and it will make no great difference whether you expose it ten hours or one hundred hours. If it is not going to fade it will not fade. That is the nature of the elimina-

tion process. We will fix that value so it will meet any depreciation in the lamp.

That same thing is done in water sterilizing. The lamps as they first go out would probably sterilize twice as much water as they are expected to, but they are so rated that they will not ordinarily depreciate to the point where they will not handle the rated capacity of the outfit.

Mr. Gordon—That would make a difference on dyes of ordinary fastness.

Mr. Buttolph—Oh, yes; and in that case, if a man hasn't the confidence of his own experience in the matter, that is a large thing. We have a great many of the laboratory outfits in use, where some one man has used it for years. For example, I think I can cite perfectly well the case of Filene's where Dr. Millard has used one of the illuminating outfits for years—and it is just a case of their judgment in the matter. Of course, if they are working with something they have never come up against before they have to use some more rigorous test; and in that case he checks the depreciation of his burners, just to help his judgment along from time to time, by making sunlight exposures as against his quartz lamp.

Mr. Jones—You might use a standard dyeing of the same nature as photometers; that is, use a standard dyeing which would fade a certain amount in a certain length of time, as a check on the lamp.

Mr. Buttolph—Yes, your committee has considered that possibility. Of course, the difficulty is to have a standard that is always comparable with the unknown—

Mr. Jones—I mean as a check on the lamp.

Mr. Buttolph—Oh, yes, as a check on the lamp; certainly, that can be done. In fact, in other fields they have used Solio photographic paper as a check of that kind.

There are several little devices that for rough work are satisfactory. They are called actinometers. They work on the same principle as the little exposure meters that they use in photography.

Mr. Febinger—I would like to know if this lamp will have the same defect that some Fade-Ometers in use now have—in fabrics of certain colors they give an exceedingly good light fastness, while others are killed much quicker in proportion than they would be in sunlight. It seems to me that yellow especially is very much favored by the Fade-Ometer. Violets and reds are killed quicker in proportion than they should be. It also seems that the chemical construction of the dyestuff has something to do with that matter—that colors which are yellow, compared with yellow, that are not fast to sunlight, turn up quite well under the Fade-Ometer.

Has this lamp the same defect?

Mr. Buttolph—I think I can say that it has—yes. But the difficulty is in defining very exactly the defect. You have had a little difficulty in doing that yourself here. You point out that one artificial light appears to discriminate in favor of certain colors, and another in favor of certain other colors. The difficulty is to tie that up with any particular color. It isn't true of all yellows, is it?

Mr. Febinger—I couldn't say.

Mr. Buttolph—And it doesn't seem to be true; that is, you say the Fade-Ometer does not favor all yellows, nor does the other favor all blues. It is something more fundamental than the question of color.

Then, another difficulty that comes up, in getting perspective on that, is that you find those same things by sunlight, in different places at different times in the year. That is what you are always coming back to, isn't it? That is, you are making a comparison with sunlight effects.

Mr. Febinger—Yes.

Mr. Buttolph—And the difficulty is to define what the average sunlight is. That is where the great necessity arises for some artificial standard.

I will have to call on chemists in the organization to contribute a discussion as to the chemical constitution of the dyes; that is entirely out of my line.

Mr. Hermann—I have had occasion for some time past to check with daylight exposures the results that had been originally produced by our research laboratory under various artificial fading devices, and what I say about the fading devices is not limited to any one type, but I consider it true of all of them. It appears when working with an unknown product one never knows when one is confronted with one of these unusual colors, which may or may not behave differently under the ultra-violet ray, whether produced in a mercury vapor lamp or arc light, and that it requires this checking-up under daylight to see whether it is an abnormal one or not.

The manufacturer of dyes or the user of dyes has very little occasion to test the fastness to light of colors the chemical or physical behavior of which is known to him. It is the unknown types that he is using, and when he is testing an unknown type he first has to determine whether or not it is one of these abnormal ones, so that the factor of safety or of assurance after having made the tests seems to be lacking.

Secondly, if he happens to be a dyer or a merchandiser of goods, he doesn't always know the exact construction of the material. If he is a paper merchant, he doesn't know whether he is dealing with bleached sulphite pulp, sulphite pulp, craft pulp, ground wood, soda pulp or any one that is exposed to light. In pure white pulp the pulp itself will give very distinct color reactions under the influence of the sunlight which are quite different under the fading light. If it happens to be leather, the character of the tannage will determine the shade produced under the light. If it be weighted silk, the reaction of the tin has an influence. If it is wool, the character of the

wool, the dressing of the wool, whether the wool has previously been stoved or not, has an influence. If it is wood, the character of the wood, the amount of tannins and mineral salts it contains, the oils with which it has been dressed play a part. If it is cotton, the character of the dressing, whether it be of an oxidizing or reducing action type, will play an important part.

The result of that is, one does not know what reaction to expect. It is for this reason that the chemist, or at least my own conclusions lead me to believe the only safe test is one which in a commercial sense reflects the actual conditions under which this particular article or commodity will be marketed. If the article is to be handled in New York, why, then, a New York exposure, to New York sunlight, New York atmosphere, New York dust, New York humidity, seems to be the safest test. If the article is to be handled by Filene, let Filene test it under conditions that his clientele will test it. If it happens to be a store out in Arizona, it would be safer to test it under the conditions that their own market will experience.

We do not find it possible to adopt an absolutely uniform standard of fading, for the simple reason that it is not possible to create a standard which will fit all conditions. And, to repeat: we do not find in our own work it possible to abide by the results obtained by artificial exposing methods, because of the many unexpected discrepancies which we later on check; and we find it advisable to wait the two or three, and sometimes five, months for the sun test before our board of directors is willing to vote the necessary funds to manufacture this or that dye.

Mr. Gordon—Do you find a great difference in the action of sun in different parts of the country?

Mr. Hermann—It is difficult to measure sunlight in different parts of the country. We take the Bureau of Agriculture reports for the total sunlight hours, and if they happen to be made in Buffalo, Wilmington or New York, the Bureau of Agriculture may say, "Sunlight exists here," and yet our exposures may be made on some roof where there is a local haze, which is very difficult to measure.

Mr. Gordon—That affects the rate, of course; and you will find, if you let it run long enough, the actual test produces about the same effect. Don't the effects compare, then, in different parts of the country?

Mr. Hermann—I can say with positive assurance that we have checked results produced in Europe, in Miami, in Buffalo and in New York—that is as far as I want to go. Those agreed absolutely, so that different observers gave the same rating to different products.

Mr. Gordon—Does the effect from the carbon arc vary greatly from the effect produced by sunlight?

Mr. Hermann—Yes. I have three dyes in mind which have upset our whole scheme. I don't like to mention names (laughter), but our experience might have been a very sad one if we hadn't checked them by sunlight.

Mr. Lewis—What does that lamp cost?

Mr. Firehock—I think I can answer that question: the price of that lamp for direct current is $350: for alternating current, as this one is equipped, it is $400. That is usually equipped with a larger type burner than the 6-inch burner.

Mr. Buttolph—I would like to ask a question: What are the variations in your sunlight results in any particular part, right here in New York City, for instance? Can you take one of these unusual dyes and get the same ratings on it in the winter or the summer or the spring?

Mr. Hermann—I think so. We have no reason to believe that we wouldn't. We have yet to find anyone to offer an exposure that would reverse our decision on it. As I say, we have had the exposures running up North here during the winter and have checked exposures sent down South, and we get the same results with the exception that the Northern ones take so much longer. It seems to be just a question of age rather than of quality.

Mr. Buttolph—And you find you can define that rate in different parts of the country?

Mr. Hermann—I don't know whether we can define it; it depends too much on local conditions. For instance, I can't qualify the rate of fading in New York during the month of January in positive numerical figures, in comparison with Miami. It means simply that we send a sample down there and have an observer down there mark the total sunlight hours and return it to us as soon as his eye sees marked fading, at which time it is recorded here; then we wait here until such time as our tests here and in other cities also show fading. I don't think that anyone has ever tried to compute any relative time ratio between the fading of the two places, because we were less interested in that than in the fading of the dye.

But in the particular dye I had in mind, which was a very important one, we found that the results under the artificial light were quite different from those under sunlight. All of the sunlight exposures agreed.

Furthermore, there was associated with that fading not only a loss in depth of color, which is one type of fading, but also a marked color change. If a yellow goes brown it is different than if a yellow merely pales out—that is, becomes lighter; and if you happen to have that yellow associated with blue, a browning of the yellow is apt to be a more serious thing than just a loss of yellow, because in the one you get a totally different shade and in the other the green merely becomes bluer.

For that reason we feel safe only in exposing under sunlight; or, our master test is one under sunlight.

Mr. Buttolph—Then, it finally comes down to your

good judgment in the matter. You haven't a way of defining it in terms, such as the Society for Testing Materials usually want?

Mr. Hermann—I must say, in the last analysis we have tried to come down to the judgment of the woman who buys the things over the counter and hangs them out of the window. We want to forestall her saying, "It is rotten!" (Laughter.)

Mr. Jones—Mr. Chairman, it would appear, from the discussion, that the whole trouble lies in the fact that there is such a big preponderance of the ultra-violet ray in the lamp. It would appear that the only thing to make it successful would be to adopt a satisfactory screen to filter out the excess of violet by a process of elimination or experiment, and provide such a screen that you would get a fading action equal to sunlight. Under those circumstances, the abnormalities would more or less disappear, and you could rely on the lamp, as Dr. Flynn says, with a gain of about three times over that of sunlight. If you were able to devise this screen, it would be able to filter out sufficient of this ultra-violet to make it comparable to sunlight.

Mr. Cassidy—I would like to ask Mr. Buttolph what the spectrophotometric ratio is compared with ordinary sunlight.

Mr. Buttolph—There are two ways of answering that: one is the result of direct radiometric measurement on the energy distribution throughout the spectrum, while the other is the result of a study of the difference in the two sources as shown by a spectrogram; that is, a photograph of the spectrum as spread out by the prism. A comparison of the spectrophotographs will show that in the case of the sunlight you have a perfectly continuous spreading out or distribution of the color, and if you have a wave length scale you will find that the spectrum ends very abruptly at about 2,800 Angstrom units; and they attribute this abrupt ending of the solar spectrum to the absorption by ozone in the very high layers of the atmosphere. It is striking, the very sharp cut-off at that point.

If you will compare with that the spectrum of the mercury arc, you will find through the violet and ultra-violet not a continuous distribution but the energy will be in little groups, and these lines or groups of energy are very closely spaced.

This matter of the spacing on a spectrogram depends on the instrument you are using. It has no significance except as a characteristic of the particular wave length sorting machine you are using; that is your spectroscope. But the significant thing is that there are not wave lengths of all kinds. But the gaps in the spectrum are very small and, as I say, unless your dye has very unusually narrow absorption bands there are lines that will come where the absorption bands lie. As you go on out with the unmodified radiation—that is, the radiation directly from the quartz burner—you will have lines extending 'way out to 2,204 and 2,300 Angstrom units, as photographed on an ordinary photographic plate. If you will use specially prepared Schumann plates, in which the absorption does not come in, it is possible, particularly in a new quartz burner, to show lines away down to 1,850 Angstrom units.

As against those two, if you will make the same observations on the spectrogram of the carbon arc—that is, the violet carbon arc (and, you know, that is an enclosed type of arc and must be used with a glass globe around it)—the spectrum is again a line spectrum, very similar to the quartz lamp spectrum, although it is more nearly what the physicists call "a banded spectrum." The lines are in characteristic groups, with a perfectly periodic arrangement in these groups. There is a sharp cut-off here at 3,000 Angstrom units. In other words, there is lacking this range of 200 Angstrom units of very effective, photometrically active radiations in direct sunlight which any ordinary glass will completely absorb.

So that it certainly seems as if in your sunlight exposures you must take into account the fact of whether you expose behind glass or directly to the sun. There certainly must be a difference, is there not?

Mr. Hermann—Yes.

Mr. Buttolph—And in the use of any carbon arc, or an incandescent lamp with a glass enclosing vessel, you do not have that very effective radiation you have in direct sunlight. In contrast with that, in the quartz lamp you have that radiation and you have a great deal of still shorter and still more effective light.

What we are actually looking for to-day is a filter that will give us a cut-off to make the radiation from the quartz lamp of the same nature as that from direct sunlight, to get our cut-off at about 2,700 or 2,800 Angstrom units.

Mr. Cassidy—That pretty nearly answers my question.

What I had in mind was: How much of the fading power is due to visible radiations from 4,000 to 7,000 Angstrom units, as aside from just the ultra-violet itself?

Mr. Buttolph—That I do not know.

Mr. Cassidy—You haven't any idea whether the visible spectrum has appreciable fading power itself?

Mr. Buttolph—I can't answer that. I don't know what the effect is. I can point out one of the very fundamental difficulties here, however, and that is your definition of what is the visible spectrum. You must remember in this connection that while as we ordinarily rate the visibility of these various colors, you will see a maximum of radiation in the yellow-green at about 5,500 Angstrom units, and there is the effective visible spectrum right in that part, if you go out toward the shorter wave lengths, by the time you have gotten out to 4,000 Angstrom units,

the radiation is still visible, but of what there is you are only seeing 2 or 3 per cent.

Mr. Cassidy—When I spoke about the visible spectrum I meant that that was perceptible in a spectroscope.

Mr. Buttolph—Roughly, that would be the green and the yellow and the red, wouldn't it? And there is a very marked difference between the quartz lamp and the sunlight and the carbon arc in this part. There is a very much greater difference certainly from the physical standpoint than the difference in fading effects would indicate. A mercury spectrum through what you call the visible range is so different from the sun spectrum that there is scarcely any comparison at all.

We know in an analogous way that in general photochemical reaction, such as the pyronation of the toluene and halogenations and reactions in general—oxidation reactions—there is very little that you can attribute to the so-called visible part. Practically all the effect lies out in the blue and violet and the near ultra-violet.

Mr. Cassidy—Does that apply to dyestuffs?

Mr. Buttolph—I don't know why we should think of the fading as different from any other chemical reaction. Certainly, just because we can't explain what the chemical reaction is, is no reason for assuming it is not a chemical reaction. We are feeling our way into it, in so far as we know; in some cases it is a case of oxidation reduction relationships between the fabric and the dye. We know that much about it, and therein it is certainly a photochemical reaction.

Mr. Cassidy—Do you believe that a color on a dyed sample would show strong absorption bands? Under ultra-violet do you think it would show a much stronger fading than under ordinary sunlight?

Mr. Buttolph—I don't know about that. I can't say whether the strong absorption bands indicate greater fading or less.

Is there anyone here who can explain that?

Mr. Gordon—I can't give the name of the investigator, nor the reference, but I remember reading a paper which stated that the fading takes place due to a wave length which is absorbed by the dye which is faded.

Another thing, Mr. Chairman: Most of the fading, of course, is caused by the short wave length lights, but there are a great number of dyes which are faded much more rapidly by sunlight than one would expect from the rate at which they are faded by the ultra-violet light. So that putting a screen under the ultra-violet would not seem to give results which are equivalent to sunlight. It is apparent that some of the effect is due to the longer wave length lights.

The dyes to which I referred were dyed on other material than cotton, and were neither basic nor direct.

Chairman Wood—Are there any further questions?

Mr. Cassidy—I would like to ask what the approximate absorption of glass over the sample is in the ultra-violet radiation. How much radiant energy does it absorb out of the ultra-violet?

Chairman Wood—You mean in sunlight?

Mr. Cassidy—Just the glass cover over the sample.

Mr. Buttolph—We think of the spectrum, for such purposes, as dividing roughly into three groups: the visible range, from about 7,000 to 4,000 Angstrom units; the near ultra-violet, from 4,000 to 3,000, and the far ultra-violet, from 3,000 to 2,000 roughly.

A crown glass filter, or even Pyrex or any ordinary type of glass, will not differ appreciably in this characteristic; it will cut off very sharply at about 3,000 Angstrom units, so that the glass will absorb all the far ultra-violet and about 15 per cent of the near ultra-violet and 8 to 10 per cent of the visible, the absorption through the visible being rather a case of reflection from the first surface. So that of the total energy in the visible and the near and the far, it is probably about 50 per cent absorbed. Of the total ultra-violet (that will be of the near and the far of just that group) there will be about 60 per cent absorbed; and, as I said of the far ultra-violet, all of it will be absorbed.

Mr. Cassidy—Do you think that would explain Dr. Flynn's results, if he used a glass for filtering out? His results with a filter show that he got the same results when he—

Mr. Buttolph (interposing)—It would certainly suggest that you are simply changing the quality of the light so it corresponds very closely to sunlight. Certainly, the physical evidence would be that it corresponds very closely, except for the fact that there are certain of the so-called visible radiations lacking in a mercury arc; and the reason, of course, that difference does not show up is that in all ordinary cases the visible will not have much effect.

Mr. Jones—Have you ever tried the effect of celluloid?

Mr. Buttolph—You mean clear?

Mr. Jones—Yes; I believe that is a very effective filter for ultra-violet.

Mr. Buttolph—Our difficulty is not to get an effective filter; our difficulty is to get filters that will transmit. There are immediately available materials that will transmit a little more radiation than crown glass. One is mica, which in very thin sheets will transmit out to 2,800 Angstrom units, which will transmit practically everything there is in direct sunlight, but the sheets must be so thin that it is impractical material to use. We couldn't get out a lot of them and say they were of uniform characteristic.

Mr. Gordon—Is the celluloid itself a proper screen? Isn't it rather rapidly affected by ultra-violet light?

Mr. Buttolph—That I don't know. I know that in

general it has never been used as one of the filter materials for practical work, and for years there has been a search going on for satisfactory filters for this work.

The Corning Glass Company are now making a filter—they call it an ultra-violet filter—which transmits out to 2,800, but out at 2,800 it is transmitting very, very little and it does not have the sharp cut-off; so that while it transmits a very little radiation, it doesn't transmit enough.

They have made in Germany in other years a series of glasses, the most perfect of which will transmit 'way down to 2,500 and 2,400 Angstrom units, and we are experimenting with those glasses now.

Chairman Wood—Are there any further questions?

Mr. Cassidy—Mr. Chairman, I would like to inquire if any of the members of the Society have done any experiments with monochromatic light, to find out the relative failure of different parts of the spectrum?

Chairman Wood—Can any member give us information on this point?

Mr. Buttolph—I can offer this analogous remark: that this effect has been studied on certain paint materials. It was once done on lithopone. In fact, the New Jersey Zinc Company, although they have reported the work in that form, have been doing just that thing within the last year or so in their research laboratory. To do this at all rigorously, you must use what is known as a monochromatic illuminator—that is, a spectroscope worked backward, so to speak—so that you can isolate any particular part of the spectrum.

The limitation for practical work is that with the largest lenses and the largest prisms it has been practical to build you cannot get enough energy through, so that sunlight testing of fastness is out of the running so far as slowness goes. Tests of this kind have been made and are being made right now over at the Rockefeller Institute—to test the specific action of various individual wave lengths on bacteria. There, you see, it is a very much more sensitive thing, and they can get effects with low intensities.

Chairman Wood—Are there any further questions you would like to ask Mr. Buttolph?

. . . Chairman Wood made some remarks, after which the meeting adjourned at 10 p. m.

[ADJOURNMENT.]

DECEMBER MEETING OF THE RHODE ISLAND SECTION

The December meeting of the Rhode Island Section of the American Association of Textile Chemists and Colorists was held as a joint meeting with the Rhode Island Section of the American Chemical Society on December 22, at the rooms of the Providence Engineering Society, 44 Washington Street, Providence, R. I.

The meeting was opened by Chairman Culver, who stated that, as the treasurer's and secretary's reports had been published, it would not be necessary to take time to read them. Mr. Culver described briefly the proceedings at the first annual meeting of the society held in New York City, December 2; and pointed out the importance of a change in the society's by-laws referring to the admission to membership of those who have been concerned in directing work involving the application of colors, as well as those who have been actually engaged in such work.

The chairman outlined his work with the Engineering Society's committee on affiliation and described the scheme of affiliation, which allows the free use of the rooms of the Engineering Society for meeting purposes, provided that members of the Engineering Society are permitted to attend such meetings. In order to establish fully the exact relationship between the Providence Engineering Society and the American Association of Textile Chemists and Colorists, Mr. Culver introduced Prof. Hall, chairman of the Engineering Society, who took a few minutes to describe his society, its aims, condition and aspirations, and its relationship to the various organizations to which it has lately offered the privileges of affiliation.

As no further business was brought foward, the chairman introduced A. N. Dana, of the Franklin Process Company and Franklin Process, Ltd., who spoke on Some of the Very Apparent Advantages of Dyeing in the Wound Form.

The attendance was about 100.

Mr. Dana's paper follows:

SOME VERY APPARENT ADVANTAGES OF DYEING IN THE WOUND FORM

By A. N. DANA, *Franklin Process Company*

In discussing the very apparent advantages of dyeing in the wound form, we must consider the subject principally from the viewpoint of the Franklin Process system. This is a very fair attitude because not only have Franklin machines led the field in machine dyeing but also because the Franklin Process Company is the largest commission yarn dyer in this country. And furthermore, whereas beam dyeing is mainly for warp purposes, and cop dyeing for filling, package dyeing is more flexible and replaces both of the others.

Some people think that package dyeing is something new. As a matter of fact, there have been cheese dyeing machines in Europe for many years, such as the Obermaier, Elton, and the Keukulare. The success attained has not been all that could be desired, however, as the penetration is unreliable. In such machines the yarn is wound on a rigid perforated tube and the packages are placed on a spindle and then held in position by a cap

and screw. As a result the column of packages is dead—when the cotton shrinks the packages fall away from the top plate and the dye channels between instead of through them. The corners are often white.

Compare this method with the Franklin process, which is protected by a basic patent. The yarn is wound on a hollow spring core like a parallel tube, covered with a knit jacket. The same number of packages are placed on each holder and then slightly compressed and the holder plate is locked in position. On each spindle then there is a uniform mass of yarn. The dye *has* to go through the packages, not between them, giving excellent penetration and levelness. Should the yarn shrink or swell the spring core compensates for this and the column retains its elacticity. It is not a dead mass—and the packages after dyeing are not deformed.

Before we consider further the significant advantages of the Franklin system we should know precisely what it is. The idea originated in the small town of Franklin, N. H., where a Mr. Daniels was experimenting with dyeing raw stock in a rotary machine using the principle of centrifugal force. He found that the harder the raw stock was packed the more uniform were the dyeings. This fact impressed him and gave him the idea which has been developed so successfully; that is, attempting to dye packages with the yarn wound in as uniform a mass as possible. It was necessary to find some kind of perforated tube on which to wind the yarn which would give this uniformity. It was by a fortunate chance that he discovered the use of the special wire spring as the core of one of his packages. By placing these on a hollow holder and compressing them he obtained the uniform mass he was seeking.

The first plant in Providence consisted of a small machine shop and a small dyehouse for demonstrating purposes. From dyeing a few pounds of yarn a day—on the early machines which were very clumsy—the commission yarn dyeing business has grown by leaps and bounds, fully keeping pace with the machine business. Last year they moved into their new plant here in Providence, which has a dyehouse second to none in the world, with a daily capacity of 40,000 pounds of dyed yarn. This last year the Franklin Process Company dyed over 4,000,000 pounds of yarn.

In addition to expanding to this new plant they have constructed a large mill in Philadelphia and last fall they constructed the largest dyehouse in the Southern States.

There are Franklin Machines in England, Scotland, Canada, India, Japan, Mexico, Sweden, Holland, and all other textile countries. The field in which the Franklin dyeing machines can be used is almost without limit. It is especially adapted for dyeing cotton, worsted, wool, mohair, jute hemp, silk noils, and novelty yarns. It can dye any yarn from hard twist voile yarns to heavy cable cord. It can dye the finest worsted that can be spun and wound. There is no shrinking or change of twist and the strength of the yarn is even improved after dyeing, owing to the circulation of the dye liquor through the yarn which seems to have the effect of setting the fibers and strengthening them.

Practically every class of soluble dyestuff can be used in the machines. For cotton—vat colors, direct, developed, basic, sulphur, and ice colors head the list. For worsted the machine will dye all kinds of colors—chromate, chrome top, chrome bottom, Acid, Logwood Blacks.

The dyed product consists of yarn wound on a parallel Franklin tube that will deliver either by rotation or over end and which does away entirely with skeins, warps and spools, and cops. Yarns counting 40/1 and finer are wound and dyed on packages three inches long by four and one-fourth inches in diameter, weighing about one-half pound each. With this size of package there is no drag when taking off the yarn over end, and when the package is rotated the fine yarn has to pull only the weight of one-half pound. For yarn coarser than 40/1 a six-inch traverse package is used which, when four and one-quarter inches in diameter, carries about one pound of yarn. This winding is done on a No. 50 Universal winder.

Recent developments have led to the adoption of the precision wind as exemplified by the Universal No. 16 winder, which is susceptible to a winding charge as low as the cost of spooling, which is a most economical wind.

After dyeing and drying, these packages are placed in a V creel on wooden arbors and run from there to the warper. The same procedure is followed in the making of pattern warps, packages of the proper colors placed in the creel. The warps are thus made up at a greatly reduced cost, because the beaming operation is eliminated. Many white goods manufacturers have taken advantage of this fact to undertake the manufacture of colored goods without putting in new equipment. They simply send their yarn to us on bobbins for dyeing and receive it back all ready for the V creel.

For the filling the packages form an ideal supply for the No. 90 Universal cop winding machine.

For the knitting trade, many knitters can knit directly from the packages—if they cannot do this the packages form an excellent supply for winding onto cones or bottle bobbins.

The Franklin machine is very simple. It is easily and quickly loaded and unloaded. In its operation, aside from the water supply valve, and the steam valve, there is only one valve to be shifted or turned, namely, the valve controlling the circulation. By one shift of this valve the flow of the liquor is reversed, so that, at the opera-

tor's will, the dye liquor may be made to pass through the package from the inside out, or from the outside in. While many dyes will give perfectly level results with no change in the flow of the liquor whatever, practice has shown that with colors that normally do not level easily, the best results are to be obtained by allowing the liquor to flow twice as long from the outside in as from the inside out.

A sampling device attached to the main container permits at any time during the dyeing operation an examination of the progress of the dyeing. All conditions surrounding the dyeing operations are very constant so that once a shade is established, it can be repeated with very uniform results from batch to batch, with no sampling or additions whatever.

It is always desirable to dye in as concentrated a dye bath as possible. As there is but one gallon of liquor to each pound of yarn dyed in a Franklin machine, the full benefit of the short dye bath is obtained.

The capacities of these machines are so great that up to 1,500 pounds can be dyed in one charge, so that you will see the great advantage in dyeing the warp and filling at the same time, thereby obtaining the exact shade. The smallest machine dyes one pound.

When the dyed packages are unloaded from the dyeing machine, they are extracted in a hydro-extractor and are then placed in trays in the dryer. The drying requires from five to eight hours.

Thus you see what a simple proposition it is for the dyer. The yarn comes to him from the spinner. It is wound on the dyeing springs, scoured and dyed or bleached in the same machine, extracted and dried, and is then ready for the weaving mill.

For the worsted trade there are either package machines identical with the cotton ones, or there are jackspool machines. In the latter case the yarn comes on wooden jackspools and is wound on a perforated aluminum jackspool on a warp compressing jack winder. It is dyed in this form, up to 500 pounds at a time. It is then dried by blowing hot air through it. When dry it is backwound onto the original wooden spools.

Now, please visualize as a contrast, skeins of worsted and compare them to a Franklin package—or jackspool. Then visualize a steam-filled, water-filled dyehouse with skein dyeing machinery. Look at the advantages of dyeing in a closed machine with yarn in the wound form, no backwinding of skeins, felting, tangling, etc., a clean, airy dyehouse. No wonder the American Woolen Company has recently equipped sixteen dyehouses with Franklin machinery.

For top dyeing the Franklin top dyeing machine operates on the same principle as the package machine and has similar advantages.

So much for a description of the Franklin system. Now what are the unique advantages?

In the first place, it uses less steam and consequently less coal. The dyeing is done in a closed kier. A closed kier easily retains its heat. Furthermore there is only one gallon of liquor to each pound of yarn; i. e., eight to one in weight. On other methods it is often forty to one, or five times as much liquor. The theoretical calculation would indicate one-fifth as much steam as in the open-tub method. As an actual illustration we know of a mill that does practically the same volume of business as the Providence plant of the Franklin Process Company, and it has fourteen boilers, compared with the Franklin's two, and we rarely use more than one at a time. This gives a ratio of one to fourteen. A most conservative estimate would be one to four.

In the second place it cuts the yarn waste and cost of winding to a minimum. On single forties hosiery yarn one girl in skein winding can only wind thirty to thirty-five pounds per day, and she would receive about $25 a week. A girl can wind 200 to 225 pounds a day at $14 a week if she winds packages. Think what that means—by eliminating the cost and waste of skein winding. The waste in package winding would only be about one-third of one per cent of yarn in this case. In all winding operations it is the simple process of winding from a tube to a tube or a cone to a tube, etc.

In fine worsted 2½ to 3 per cent of dyed yarn can be saved by eliminating skein winding. With yarn at $2.50 plus 25 cents for dyeing, this saving alone would quickly pay for Franklin dyeing equipment.

In the third place, the process requires but a small floor space. A gingham mill was laid out for chain warp dyeing. The Franklin process was suggested after the plans and estimates were made. On the rearrangement to adapt the buildings, the saving of construction charge due to the smaller floor space much more than paid for the complete dyeing equipment.

In a space 40x24 feet we have five 500-pound jackspool machines turning out two lots a day or 5,000 pounds of worsted in all per day. This means 1,500,000 pounds of yarn per year. Can you imagine any other system in the world dyeing 1,500,000 pounds in a year in a space 40x24 feet?

In the fourth place, it requires less manual labor. On an output of 21,000 pounds of dyed yarn less than twenty-one men are required. A few months ago I took an English customer through the Franklin Process English plant and he saw 1,000 pounds of his wool yarn in the process of dyeing. One man was handling the work. He said he was ashamed to tell how many men were required in his skein dyehouse to handle 500 pounds per day.

The Franklin process is estimated to save 50 per cent in labor and as skilled skein handlers are not needed the

labor is low priced in addition. In the fifth place, the Franklin process system gives a clean, healthy dyehouse —no steam-laden water-soaked atmosphere. The Franklin process dyehouse in Providence is reckoned to be the finest dyehouse in the world. It is an ideal plant. I was standing in the center of it one day when a visiting dyer came to me and asked me where the dyehouse was. And he was in the very center of it.

In the sixth place, owing to the short dye bath, the savings in dyestuffs and chemicals are very great. I visited one big thread mill lately which had several Franklin machines placed among their Hussongs and tubs. An old dyer, over 70 years old, was in charge. He told me he had never had any trouble in using the new machines —that he had always cut down on his recipes by 15 per cent and proceeded as usual.

In all operations where the density of the mordant or dye liquor is a factor, the possibility of saving is very large; for example, tannic acid, naphthol A. S., etc. The machines being enclosed, the loss of hydrosulphite or of sulphide from oxidation is minimized.

A seventh advantage would cover the ease of dyeing, as such large lots can be dyed in one batch, avoiding the matching of many smaller lots for the same shade. The amount of dye liquor being constant, the conditions of dyeing are very uniform.

Our eighth point would cover the advantage to the weaving mill. Let us compare the two processes of handling warp yarn. First by the chain warp system; secondly, by the package system.

In the Chain Warp System.—The yarn is spun on spinner's bobbins; it is wound onto spools; it is made into a chain warp. After this it is dyed and dried and split, and then one of the worst operations follows—the beaming of the long chain warp.

Look at the Ease of the Package System.—Bobbins to package; dye and dry, and the packages are then ready for the V creel, and are beamed directly.

LET US COMPARE THE COST OF THESE OPERATIONS

Chain Warp System—	
Spooling and warping 40's	0.04
Long chain beaming and splitting	0.09
	0.13
Franklin Process System—	
Winding	0.02
Warping	0.015
Reclaiming short ends	0.01
	0.045

Thus it is 4½ cents against 13 cents, or 8½ cents per pound difference.

This means that on 500,000 pounds of dyed yarn per year a mill can save $42,500. What mill can afford to lose this amount of money?

I have stressed a few of the economical features of the process. I have been saving the most important advantage until the last. It is that of quality—penetration, depth, solidity, brilliance. Warp dyeing is simply a painting process. Warp dyers pass the yarn through the dye. In the Franklin method you pass the dye through the yarn. This gives a solidity and brilliance in tone unattainable in warp dyeing, especially in vat colors. This quality is particularly noticeable after goods containing such colors have been laundered several times. It is a quality that the consumer is bound to notice.

One large manufacturer in Pennsylvania who makes ginghams, using vat colors and bleached yarns, i. e., without bleaching in the piece, has gone into the matter with Teutoniclike thoroughness. And they have decided to replace their warp dyeing machinery with Franklin dyeing equipment. And their reason is based on *quality*.

It is for *economy plus quality* that the American Woolen Company has just equipped sixteen of their mills with Franklin equipment, including William M. Wood's new model mill, the "Shawsheen Village Mill."

One important wortsed manufacturer states that in 1922 they made 7 cents per yard greater profit on every yard of yarn dyed goods in their plant than similar mills with skein dyeing machinery due to their Franklin package machines.

I would like to quote from a letter from one of the largest cotton converters in New York, wholly unsolicited:

"We beg to acknowledge receipt of your color card, for which accept our thanks. We desire at this time to say that we have been more than pleased with the colors which you furnished our manufacturers this past season for our account. They have shown up very well and have proved in every way satisfactory."

In closing, I wish to refer to an article from the American Wool and Cotton Reporter, issue of October 19, concerning the Bates Manufacturing Company, which says:

"The agent of the Bates is an aggressive and capable manufacturer and knows the value of speculative experimentation. These large gingham mills in many cases dye and bleach as much as possible their product in the raw stock. Agent Stewart is changing this, and he isn't fooling with beam dyeing machinery, but is putting in Franklin process equipment, and having great success with it."

DISPUTES IN RELATION TO TEXTILE FABRICS

(*Continued from page* 134.)

on the yarn as it is being drawn from the bobbins or cheeses that may be in the creel.

Looming defects are usually found out before the piece has been woven very far, and the same may be said of wrong drafting and of sleying—i. e., passing the warp threads through the reed which is to be placed in the batten of the loom; but if it be a case of using a wrong reed or one that is not suitable for the weave in question, it is possible that the cloth may not only become woven but also finished before the defect is found out.

To give an example in point: Some years ago I had to investigate for a spinner the cause of a certain defect in a piece which was asserted to have been made by the yarn supplied by the spinner. After careful investigation it was found that the yarn was not at fault, but that the cause was the improper slaying or passing of the threads through the reed in relation to the weave, and not applying the proper shedding methods in the weaving to assist in obtaining proper cover on the cloth.

Weaving Faults

In the weaving operation many faults may arise. A number of them can be easily designated as weaving faults, but there are others which on a casual observation may be taken to have been produced in other departments.

These are more difficult to determine and, before any decision is taken, should be carefully investigated. For example, a piece on being finished and placed over the perch may be found to have innumerable specks of a deeper color than the rest of the piece, as though it had been peppered with that color. This can be, and is occasionally, caused by loops being formed by the weft in the woven piece, by its coming off the bobbins too slack in tension, and the shedding of the warp threads not being made sufficiently clear, so that when the piece is being cropped or cut in the finishing department these loops are cut off and the protruding fibers give a fuller appearance in color than the other portions of the piece.

Another case of bars across the piece may be taken, which are shaded from the beginning of a bobbin to the finish of the same when being woven. This does not show in the gray piece, but is clearly shown when dyed and finished. This arises in pieces where a high count of yarn of fine quality is used for the weft, and to eliminate this it requires the combination of the spinner and manufacturer. Should the weft be supplied by the spinner on the ordinary size of weft spools, this fault will certainly be the result in the pieces; but to mitigate it, it is usually supplied on a spool that is much shorter in length. The graduation in shade is caused by the variation of drag created by the friction between the yarn and bobbins as it is drawn from the spool or bobbin. As it gets nearer the bobbin head the drag is increased.

(*To be concluded.*)

WHAT COTTON DOES WHEN IT'S THIRSTY

By E. H. Davis

Cotton Research Company, Inc.

THE subject of humidity is one of general interest and importance to those engaged in the business of manufacturing cotton, whether actually employed in the mill or affiliated with it on the outside. The manufacturer's main concern is that he be able to consistently maintain certain humidities which he has found by experience to be best adapted to the running of the work in the several departments of his mill. A most important aspect arises in connection with the large influence of humidity, or more specifically, its twin brother, regain, on the results of tests of textile materials. Before discussing these phases of the effects of humidity it might be well, for the benefit of those not particularly conversant with it, to give brief consideration to humidity itself.

It is well understood that the dampness of the atmosphere in which textile manufacturing processes are carried on is of primary importance. C. H. Lander, in his book, "Ventilation and Humidity in Textile Mills and Factories," tells us that this was generally recognized by the early spinners and weavers and indicated by the fact that hand looms, etc., were often installed in a damp portion of the worker's cottage, the earth floor was watered, if necessary, and wet cloths hung round or near the warp beam. Then the building of large mills, after the introduction of the spinning frame and power loom, tended to rapid growth in districts where the natural amount of atmospheric humidity was great. The localization of cotton spinning and weaving in Lancashire and that of flax spinning and linen weaving in the north of Ireland is partially accounted for by the moist climate of those districts. In this country we have the similar case of New Bedford. Artificial humidification made its appearance during the latter part of the last century, and to-day we have several large manufacturers of such equipment, the use of which is great and varied and includes practically all processes of manufacture where it is desirable to create and control atmospheric conditions.

As to humidity, the language of Mr. Lander appeals through its clarity. The wetness or dryness of air depends upon two factors: firstly, the absolute amount of water vapor present in unit volume of air and, secondly, the temperature of the air. A cubic foot of air at any given temperature can absorb only a certain definite amount of vapor; when the air actually holds this quantity, it is said to be in a state of saturation. If the amount of moisture present exceeds this amount, the excess can only exist as water, which is either precipitated or suspended in the air in the form of finely divided drops.

If the air does not contain a sufficient quantity of vapor for saturation, its degree of wetness is measured by the ratio of the quantity actually present to that quantity which would be present if the air were

in the sateurated state. This ratio is termed the relative humidity and if converted to a percentage is known as the percentage humidity.

The absolute amount of water vapor necessary to saturate a given volume of air increases with the temperature of the air and from this it follows that if we heat air containing water vapor (as raising the temperature in a room in the mill) the relative humidity falls; on the other hand, if we abstract heat from air containing water vapor (cool the room) the relative humidity rises until at some definite temperature the air becomes fully saturated; this temperature is called the dew point, since if the temperature be lowered still further, vapor must be condensed and will usually be deposited in the form of dew.

That this dew-point temperature has been reached, many of us have witnessed in the moisture laden windows of the mill, and, unfortunately, on the walls in mills of concrete construction, as well. Windows are always apt to cause condensation, due to the fact that a thin glass window is a good conductor of heat. The cold outside air chills the glass, which causes the temperature of the warm, moisture-laden air film on the inside of the glass to be lowered to a temperature below its dew point, and thus we have condensation. A similar phenomenon occurs in the case of the concrete walls; this material itself being a good conductor of heat. It does not occur in brick construction, since this material is porous and hence a poor heat conductor.

Returning to the consideration of humidity and its effects in the mill, if yarn be exposed to air of given humidity it will either absorb or yield moisture until an equilibrium is established between the moisture in the fiber and that in the surrounding air. The amount of moisture in the fiber is influenced also by the dry bulb temperature, but to a relatively small degree. Thus, if the yarn had 6.1 per cent moisture in an atmosphere of 61 per cent relative humidity at 70 deg. Fahr., the amounts of moisture it would contain would be reduced very slightly for dry bulb temperatures higher than 70 deg. Fahr., and increased very slightly for dry bulb temperatures lower than 70 deg. Fahr. Hartshorne has expressed this in effect that regain is inversely proportional to absolute temperature.

The primary necessity of moisture in the mill is due to the fact that during manufacturing processes, cotton becomes electrified by the friction generated in passing through the machines, the fibers are caused to stand out by their mutual repulsion and thus escape being properly spun. The result is loose, rough, and uneven roving and yarn of consequently poor quality. The same troubles occur in weaving and in this case, warp sizing with starch compounds assists greatly in overcoming the difficulty.

There is probably some difference of opinion among manufacturers as to the humidities which are best suited to the satisfactory running of the work in the several departments of manufacture. Generally speaking, a low humidity is desirable in the opening and picking processes, since the cotton may be more readily opened, shaken and freed of its leaf and dirt, when comparatively dry. About 55 to 60 per cent relative humidity is desirable in carding, increasing to 65 per cent in spinning, and about 70 per cent in weaving.

As to the effect of humidity during the process of testing, as reflected by the moisture content of the test specimens, it may be said that the importance of this factor has only comparatively recently been recognized, at least to the extent of being given definite consideration. It has been determined in our laboratory that the skein strength of a yarn tested while containing 3 per cent regain will be from 15 to 30 pounds less than when tested while containing 9 per cent regain. This represents the extreme difference occurring within normal limits of moisture and the intermediary differences fall along a comparatively straight line, speaking graphically. The usual procedure for taking into consideration the effect of this moisture variable on strength is to correct to an optional regain basis, ours being 6½ per cent. By this means, the yarn may be tested in any known atmospheric condition and the correction applied, thus providing a standard basis and making possible accurate comparisons at all times.

The sizing of processed cotton, as well as yarn, may be handled similarly, all corrections being made in accordance with tables which have been prepared for the purpose. And lastly, the application of corrections to cloth testing is of equal importance. Here we encounter other variables having to do with weight, construction, and crimp, and considerable experimental work in this instance remains to be done in connection with definitely determining the rates of strength increase with moisture increase for a rather wide variety of fabrics, covering those just heavier than gauze to belt ducks. Pending the accomplishment of such research work, generally accepted correction formulas are being used, or strength tests are made after conditioning the fabric in the laboratory where constant atmospheric conditions are maintained, either of which procedure provides reliable comparison. The point of the matter is that strength tests of textiles are of little use, in fact, are very misleading when the moisture variable is not considered.—Builders.

NOTES OF THE TRADE

The Adenzit Company, Long Island City, N. Y., has been incorporated with a capital of $15,000, to manufacture chemicals, dyes, colors, etc. The incorporators are W. C. and I. W. Kober, and T. Moore. The company is represented by J. K. Gillette, 424 Stein Avenue, Long Island City.

Baxter, Kelly & Faust, Inc., New York, was recently incorporated to manufacture silk and other fabrics. Capital, $50,000 to $1,500,000.

FROM THE JOURNAL OF A HOSIERY DYER

(*Concluded from page* 132.)

dyeing and fast. They cost more by the pound, but when you only use a part of an ounce what's the cost after all!

April 5.—Got out a lot of bleached white on cotton and art silk to-day. Did it with a weak chemic (bleaching lime) and didn't have to use peroxide; but peroxide's best when you have real silk, for chemic knocks it all to pieces.

April 16.—Been having things my own way for a month now. We're only using the Sulphur Black kettle for children's ribbed and lisle socks. I'm using Developed Black on all the mercerized ladies' and silk goods and the luster holds out a lot better. I've got a dandy scheme for finishing them. I take about five buckets of the boil-off from the silk goods and run them for five minutes at 120 degrees and then put in a couple of pounds of acetic, just enough to make it milky, and run ten minutes more and whiz. They fill up and get more body, look fine and have a great scroop, and it doesn't cost anything because we used to run the boil-off down the sewer and bought a softener besides.

May 4.—They've begun making a new style now. Mercerized tops with real silk and art silk twisted in the boots. The Developed Black looks swell on them, but I have to make cordovan and pearl. The samples I made look like heathers; all the color is on the art silk.

May 6.—Found out the trouble to-day. Some dyes do and some don't dye art silk heavier than mercerized cotton and then even with the good ones if there is any soap left in the goods after the boil-off and rinse the art silk dyes heavy anyhow. I got over this by rinsing with a little acetic before I dyed and didn't have any trouble at all. I had to use some neutral wool dyes to get the real silk right because it always gets redder anyhow and needs blue to pull it back.

June 7.—The bleached cotton has been getting yellow and tender so I took it up with a chemist of one of the drug houses. He blamed it on the muriatic I was using to sour off. He says I used too much and I had better use a little bisulphite also to kill any chemic that might be left in the goods.

(*To be continued.*)

Handy Graphics—IV

Slide-Rule Applications

To Watch the Fall in Prices—To Determine Percents Quickly—To Compare Formulas

CHARLES F. GOLDTHWAIT

Baltimore Processing Company, Baltimore, Md.

and

JOHN E. HOFF

Klearflax Linen Looms, Inc.

Part Four of a Series on Textile Chemical Uses of Ratio Paper and Logarithmic Scales

WE have already noticed that logarithm paper encroaches upon the territory of the slide rule, but for some uses you can even cut off a piece and slide it along another, and then the combination really becomes a primitive slide rule. The chart, however, with its supplementary scale, can be "set" for a given purpose and then filed for future use.

Our first illustration, *Fig.* 1A, shows a small section of a record, Table 1, of dye prices on a falling market, actual figures over the last few years.

TABLE 1

Dye	1917	1918	1919	1920	1921	1922	Total Decline
1	4.50	4.00	3.20	2.60	1.75	1.35	70.0%
2	2.00	1.50	1.25	0.80	0.70	0.35	82.5%
3	....	....	0.40	0.20	0.15	0.15	62.5%

By using a reading scale, *Fig.* 1C, that has the same rulings as the chart, and the percentage figures as shown, it is possible to read the per cent decline in price at any point. Simply place the zero opposite the higher figure and read the percentage drop in price opposite the lower.

The method of graduation is simplicity itself. By looking at the figure it is seen at once that if we take $1 as our base it will be zero on our new scale (C), $2 is 100 per cent more than $1, so it will be 100 per cent; $3 is three times $1, or twice as much more, therefore it will be 200 per cent, and so on up. Working downward, 90 per cent is 10 per cent less than $1, so it becomes 10 per cent, and so on down to 10 cents, the limit of our chart, which is 90 per cent less than $1, and is therefore marked 90 per cent. Always read

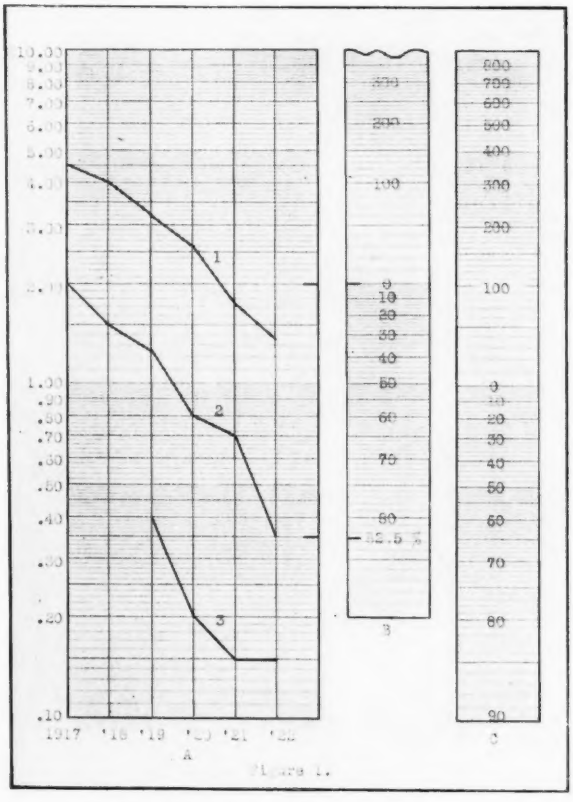

FIG. 1—*Per Cent Decline in Price*

your advances on the scale above zero and the declines on the section below.

You can easily prove that it works just the same at any other point, owing to the fact previously stated that equal percentages anywhere on the chart are represented by equal vertical distances; i. e., a scale worked out for any one point ($1) will apply to any other. For example, B, which is the same scale as C, is applied to curve 2 and shows at once that this color has declined 82.5 per cent in price when referred to the original 1917 figure as a base.

FORMULAS FOR MIXTURES

Log scales offer a simple method for calculations involving formulas for mixtures of materials—for instance, in the color shop—or for any other "composition of matter."

Here is an old print paste:

TABLE 2

50	parts water.
20	parts glycerine.
12	parts 35 per cent caustic.
8	parts Blue R.
8	parts Hydraldite C sol. (1:1).
2	parts Beta Naphthol.
100	parts thickening.
200	parts total.

How much of each ingredient will be required for sixty-five gallons, assuming that a gallon weighs ten pounds?

Transfer the amounts to a sheet of paper as indicated at *Fig.* 2A along with the total by marking across from an ordinary log ruling. Then place the total required number of pounds opposite the total pounds in the first formula, now indicated on the paper as shown at 650 in *Fig.* 2B, which is merely the strip A moved to a new position. Read off the required amounts opposite the points on the plain sheet and get the results shown at the right. (Also calculated as Table 3.)

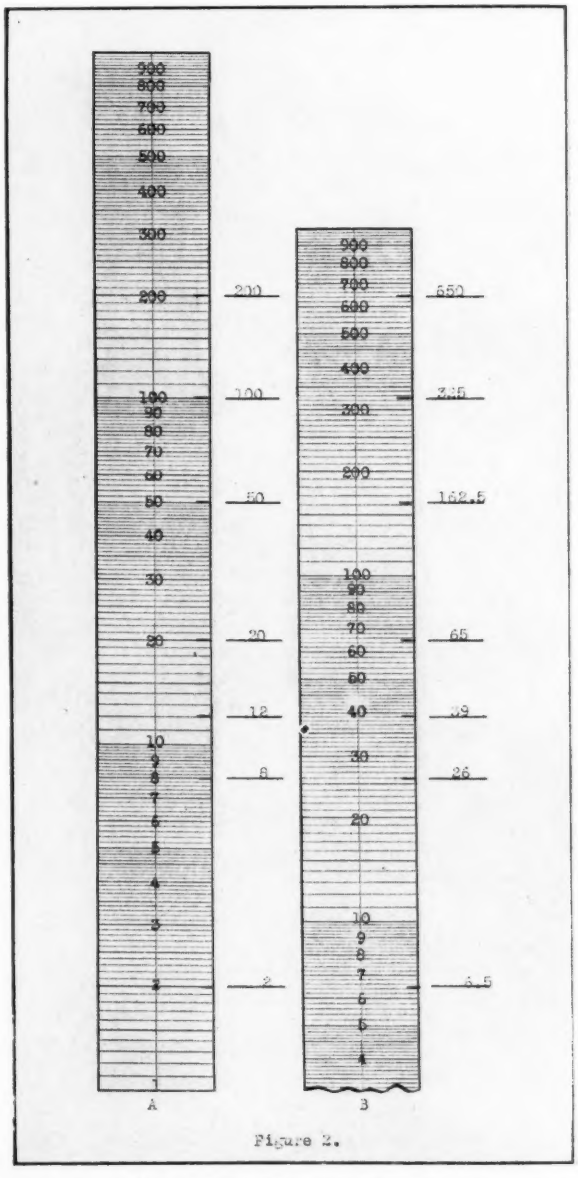

FIG. 2—*A New Formula from an Old One*

TABLE 3

162.5 parts water.
65.0 parts glycerine.
39.0 parts 35 per cent caustic.
26.0 parts Blue R.
26.0 parts Hyraldite C sol. (1:1).
6.5 parts Beta Naphthol.
325.0 parts thickening.

650.0 parts total.

The accuracy is sufficient, as it depends entirely on the size of chart, and can be made whatever one wishes.

Use the same system to convert a dye formula quickly from one weight of goods to another.[6]

When You Need the Per Cents

The next type of problem covers the comparison of mixtures in terms of percentage. Here are some old prussiate black formulas that will answer the purpose. They are given for various amounts of print paste and we want to see if they have the same relative composition. To determine this, they have all been spotted on a piece of ratio paper (*Fig.* 3 from data in Table 4):

TABLE 4

	Aniline Oil	Hydrochloric Acid	Sodium Chlorate	Sodium Ferrocyanide	Total Paste
1	36.0	13	13	34.5	675
2	64.0	18	30	47.5	1,000
3.	41.5	12	14	28.5	534

To get the per cents use a slide graduated just like the paper but marked 100 per cent at the top and 1 per cent at the bottom (*Fig.* 3C).

For Formula 3 place the top of the slide opposite the total paste, *Fig.* 3B, which is 100 per cent and read the other percentages from the slide opposite the corresponding points.

To save complications, our sample charts so far have each been based on a single unit. The reader can readily work out details for any practical case. Formulas involving several units, or which appear to require charts with a large number of cycles are readily handled and made to fit ordinary sheets of paper. For special purposes any reasonable accuracy can be obtained by selection of large enough scales.

As is so often the case with charts these methods will not be worth the trouble of working out for use with a few isoated cases but they can be hsed to good advantage for routine work on large amounts of data.

This type of work is especially well covered in Reference 4.

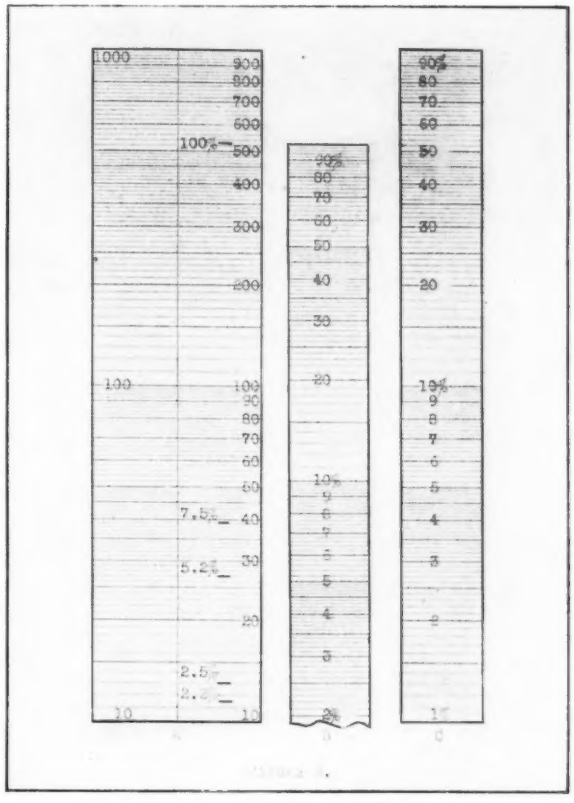

Fig. 3—*Per Cents in a Mixture*

2. "Graphic Charts in Business. Allan C. Haskell. Codex Book Company (1922).

4. "The Ratio Chart and Its Applications." P. A. Bivins. Industrial Management, July to October, 1921, inclusive.

5. "Charts for the Dyehouse." Charles F. Goldthwait and John E. Hoff. American Dyestuff Reporter, Volume X, page 325 (May 8, 1922). Covers a method which can be used for the transformation of formulas.

6. "A Handy Dyer's Proportioning Chart." N. G. Near. National Cleaner and Dyer, October, 1922.

NATIONAL GIVES NEW POST TO RIMBAULT

E. L. Rimbault, formerly reclamation manager of the National Aniline & Chemical Company, Inc., at the Buffalo plant, has been appointed manager of the Intermediate and Certified Food Color Divisions. Mr. Rimbault will be located at the main office of the company, at 40 Rector Street, New York City.

The products of this division will be sold and distributed as in the past, through the main and branch offices.

CHICAGO OFFICE FOR JOHN CAMPBELL CO.

John Campbell & Co., 75 Hudson Street, New York, has announced the carrying of a complete line of dyestuffs in Chicago, where the company has opened an office, laboratory and warehouse, at 1709 West Austin Avenue, that city.

All requests for samples, color matching, etc., will receive prompt attention. The company is being represented by Samuel T. Worcester and Joseph Hochstadter.

Mercerization by the Use of Alkaline Chrome Mordant

Observations of Huebner and Knecht—Valuable Property of Mercerized Cotton Overlooked—Mercerization by Koechlin's Alkaline Chrome Mordant—Other Methods—Cold Dyeing—Compound Mordants

By JOSEPH POKORNY

THE mercerizing process—treatment with strong sodium hydroxide—imparts to the cotton fiber slightly basic properties similar to the basic properties of the wool fiber. For this reason mercerized cotton attracts acid colors, including direct colors, from cold or hot acidified dilute aqueous solutions. On this point Huebner (Jour. Soc. Chem. Ind., 1903, p. 76) stated: ". . . since the increased tensile strength, resulting from mercerization, is accompanied by an increased affinity for direct colors, but with no appreciable change in the affinity for basic dyestuffs, such as Methylene Blue . . ." Knecht (Jour. Soc. Dyers & Col, 1908, p. 67): ". . . it would almost seem as if the treatment with alkali had enhanced the faintly basic properties of the cellulose . . ." Neither Huebner nor Knecht deduced from these observations the important conclusion above mentioned.

Knecht's dyeing with Benzopurpurine 4B was repeated with his proportions (1) alongside a parallel trial in an acid bath (2).

(1) A 5-gram hank was mercerized without tension at 50 to 60 deg. Fahr. for some minutes with NaOH 35 deg. Tw., and washed very well with water. The hank was dyed in 100 c.c. water, 0.15 gram dyestuff (3 per cent), 0.25 gram soda ash (5 per cent), 0.50 gram common salt (10 per cent) for one hour at 175 to 195 deg. Fahr., washed twice and dried.

(2) A 5-gram hank, mercerized along with No. 1, was dyed for one hour at 175 to 195 deg. Fahr. in 100 c.c. water with 0.15 gram of dyestuff and 9 c.c. of acetic acid (1 per cent) were added slowly to the dye bath. The hank was washed twice and dried. The dye bath was almost exhausted.

The strength of the shades No. 1 and No. 2 is the same, and the red No. 2 is as bright as No. 1; and it is probable that all sulphonated azo dyestuffs can be dyed on mercerized cotton from dilute, aqueous, slightly acid solutions in the same strength as when dyed in the usual way from an alkaline bath. Further experiments, indeed, proved that other acid dyestuffs, sulphonated or carboxylated, can be similarly dyed.

When No. 1 and No. 2 were soaped, cold and hot, the fastness was approximately the same; soaped hot, No. 1 looked to be a little faster. The fastness to soap of each color depends upon its constitution.

I offer no explanation of the fact that this valuable property of mercerized cotton has been overlooked; possibly the usual passage through dilute hot acid after washing has veiled it.

The action of hot dilute acids after mercerizing was determined by the following experiment: Two 5-gram hanks (Nos. 3 and 4) were mercerized in the same way as No. 1 and No. 2, washed very well, and one of them (No. 4) was treated for fifteen minutes at 140 to 175 deg. Fahr. in 250 c.c. of water and 25 c.c. hydrochloric acid 36 deg. Tw., and well washed. No. 3 was not treated with acid. Half each of 3 and 4 was then dyed exactly as No. 1, and the remaining halves exactly as No. 2. All four dyeings were of the same shade and of the same brilliancy, but in both dyeings the strength of the hank treated with dilute hot acid after washing from mercerizing was 30 to 50 per cent weaker than the other. It is probable that this property of mercerized cotton fiber is due to the formation of an active but labile basic compound, which can be easily transformed into its less active form.

The formation of this active but labile basic compound increases with the strength of caustic soda. The art of mercerizing under tension on the mechanical as on the chemical side may have reached its height, but the best conditions of treatment to give cotton the maximum basic properties require much further investigation.

Koechlin's Alkaline Chrome Mordant

Alkaline Chrome Mordant.—Horace Koechlin's alkaline chrome mordant, as it mercerizes as well as mordants, imparts to the cotton fiber basic properties similar to the basic properties of the wool fiber. These basic properties are partly due to the presence of chrome compounds, and are stronger than the basic properties described above. Therefore, this chrome mordanted cotton fiber is capable of fixing, from dilute, neutral or slightly acid dye baths, cold or hot, all kinds of acid colors, including "direct" colors in much deeper shades, than by the usual direct dyeing methods.

This chromium mordanted cotton also fixes different organic and inorganic faintly acid chemical compounds. I proved this to be the case with wool and silk in 1892 and 1893 (Bul. Soc. Ind. Mulh., 1893, "Note sur la formation des couleurs azoiques sur les fibres animales," and Bul. Soc. Ind. Mulh., 1895, "Notes sur quelques nouvelles formations des couleurs azoiques sur tissu de coton, laine et soie"). See also Chem. Zeit., 1896, p. 736,

"Progress in Dyeing and Printing," Ger. Pat. No. 77,552 (M. L. B.), 1894; Ger. Pat. No. 291,021 (Bayer), 1916.

The reader may compare Horace Koechlin's original paper, "Note sur la fixation de quelques matieres colorantes artificielles par les mordants metalliques" (Bul. Soc. Ind. Mulh., 1882, and Seances du Comite de Chimie, 1889, p. 38), with my own observations.

The behavior of cotton prepared with this alkaline chrome mordant is entirely peculiar in several respects: (1) It fixes from aqueous dilute solutions all kinds of azo colors with the exception of basic azo colors, and the dye bath is exhausted; (2) the dye bath may be neutral or acid, depending upon the chemical constitution of the dyestuff. Thus, for example, Diamine Sky Blue dyes as the barium salt better than as the sodium salt. In the same way the zinc, magnesium and calcium salts have been compared; (3) the more sulphonated the dyestuff the easier the dyeing. For example, Diamine Sky Blue may be dyed, cold or hot, from dilute aqueous solutions, as dark as the usual dark indigo shade.

Other Methods

The following methods or patents are entirely different from my methods, described in this paper: (a) Ger. Pat. No. 168,156, 1907, W. Warr, "Fixation of Direct Azo Colors on Cotton Prepared with Manganese Hydroxide"; (b) Ger. Pat. No. 272,987, 1911, and Ger. Pat. No. 247,102, 1912 (M. L. B.), "Fixation of Direct Azo Colors on Cotton Prepared with Nickel Hydroxide."

(4) The same chrome mordanted cotton fixes, moreover, all other acid colors; for example, sulphonated or carboxylated triphenylmethane or anthraquinone derivatives. In a word, it fixes all acid wool and silk colors, from cold or from normally heated, dilute solutions, slightly acidified with acetic acid.

(5) The fastness to soap depends upon the constitution of each color. Thus, while the deep shades of Diamine Sky Blue are not at all fast to washing with water, some other azo dyestuffs are faster to washing but not fast to soaping. Erio Chrome Azurole B (Geigy) (Schultz No. 551), a carboxylated triphenylmethane dyestuff, dyes a dark prune, very fast to hot soap. In the same manner Alizarine Saphirol B (Bayer) (Schultz No. 858), a disulphonated anthraquinone dyestuff, dyes a dark green, very fast to hot soap.

Erio Chrome Azurole B, a well-known and important wool color, has not been proposed for cotton dyeing. It was known that it dyes on aluminum or iron mordanted cotton, but these shades are easily destroyed by cold soaping.

Alizarine Saphirole B is also an important wool color; it is scarcely used on cotton, because the lakes formed with aluminum mordant (the only one recommended by Bayer) are not fast to soap.

Cold Dyeing

As mentioned above, many of these colors may be dyed from dilute, slightly acid dye baths without heating in very dark shades, the dye bath being exhausted. Of course, this cold dyeing takes a little longer, especially for dark shades, but it requires little attention, and a line of dyeing machines may be at work with one workman. In some cases the more dilute and the more acid the dye bath the quicker the exhaustion.

A striking fact is that colors like Erio Chrome Azurole B or Alizarine Saphirole B, which contain hydroxyl groups in special positions, dye on this chrome mordanted cotton in cold dyeing entirely different shades from the final shade, and these cold-dyed shades are not fast to washing, but develop the final shade, which is very fast to hoat soap, by a short steaming without pressure.

Thus, Erio Chrome Azurole B dyes, cold, a reddish brown and changes by short steaming into a dark prune, very fast to hot soap; and Alizarine Saphirole B dyes, cold, an indigo blue shade, and changes after short steaming into a dark green shade, very fast to hot soap.

The chrome mordanted cotton is capable of fixing other metallic mordants. By steeping overnight in solutions of different strengths of mordants we use daily in our trade: (1) chromium acetate (neutral); (2), aluminium sulphoacetate (basic); (3), aluminum sulphocyanide; (4), nickel sulphocyanide. The second mordant was fixed on the cotton. A piece of white cotton was put into the same solutions. Next morning these samples were thoroughly washed in much cold water and dyed with Alizarine for one hour. Along with these twice mordanted samples was dyed a sample of the alkaline chrome mordanted cotton. The shades on the combined mordant—(1), Chromium plus Chromium; (2), Chromium plus Aluminum; (3), Chromium plus Aluminum; (4), Chromium plus Nickel—were entirely different from the shade on the alkaline chrome mordant alone.

Compound Mordanting

This is a new and very cheap method of compound mordanting. The comparison with the white cotton samples, mordanted and dyed in the same bath and washed after dyeing, shows that white cotton fixes traces only of the mordants. The Chromium plus Chromium and the Chromium plus Aluminum shades were fas to hot soap, but the shade Chromium plus Nickel was not fast to hot soap. According to Werner's studies, the different OH and ONa valences in the alkaline chrome mordant may be saturated in different proportions, and this may explain their different behavior.

Instead of inorganic, slightly acid compounds, we can fix, on the same alkaline chrome mordanted cotton, by mere prolonged immersion in the cold aqueous solutions, (1) most of the diazo and tetrazo compounds: the cotton is impregnated, squeezed, rinsed and coupled with appropriate naphtholic compounds in aqueous (not alkaline) solutions, each compound requiring a special study; (2) different organic intermediates, as chromotropic acid, H-acid, J-acid and others impregnate, wring, rinse quickly, wring and couple with appropriate diazo or

tetrazo compounds. An alkaline solution of these intermediates cannot be used. Each combination requires its special study.

Some technically valuable shades have been obtained in both ways; but having thus proved the value of the process, the further working out must be left to other interested chemists, as it is impossible for me to continue this work. As an example, para-nitro-aniline-azo-salicylic acid may be produced in this way; the chromium mordanted cotton is immersed for some time in a dilute aqueous (not alkaline) solution og 1.38 grams salicylic acid, in the form of sodium salt, with 0.85 c.c. NaOH 76 deg. Tw., in 50 c.c. hot water, along with white cotton for control purposes. These were squeezed, rinsed and put into diazotized para-nitro-aniline, neutralized with sodium acetate, and then washed and soaped. While the white cotton did not give any color, the alkaline chrome mordanted cotton developed the usual orange shade. This shade is fast to soap, but its fastness to hot soaping can be increased by a short steaming. Many of the reactions described in this paper are in daily use in our works.

The undermentioned sealed letters, deposited with the Societe Industrielle de Mulhouse, deal with the observations dscribed above: No. 2448, December 5, 1921; No. 2452, December 21, 1921; No. 2461, March 1, 1922; No. 2472, May 5, 1922.

The alkaline chrome mordant used was prepared as follows: Precipitate 1,000 grams of chrome alum, dissolved in hot water, with 330 grams of soda ash (in solution). Wash well and filter. This gives approximately 2,000 grams of chromium hydroxide paste. Dissolve this paste at about 150 to 165 deg. Fahr. in about 500 grams of acetic acid, 99 per cent, which gives a dark violet solution. Keep at this temperature until the violet acetate of chrome has changed into the green form. Dilute with water to 23 deg. Tw.; 1,000 c.c. of this green acetate of chrome, 23 deg. Tw., cooled to about 50 deg. Fahr., are poured into a mixture of 1,500 c.c. caustic soda, 64 deg. Tw., and 500 c.c. water, previously cooled to about 50 deg. Fahr. A dark green alkaline chrome mordant solution, approximately 44 deg. Tw., is obtained. Cooling before and during mixing is essential.

Another method of preparing the alkaline chrome mordant is the following: Dissolve 1,000 grams of chrome alum in 5,000 c.c. hot water, cool to about 50 deg. Fahr., and pour into 2,500 c.c. caustic soda 72 deg. Tw. previously cooled to about 50 deg. Fahr. A dark green alkaline chrome mordant solution, approximately 32 deg. Tw., is obtained.

After padding at about 50 deg. Fahr. with the mordants, steeping for several hours, and washing well with much cold water, the cotton is ready for dyeing. When dry, this mordanted cotton is almost waterproof and must be boiled very well with water to be completely wetted before entering the dye bath.—Jour. Soc. Dyers & Col.

WATER IN SILK WEIGHTING

In weighting silk with stannic chloride there are two kinds of water to be reckoned with. The first is the water to be used in the washing bath that comes directly after the impregnation of the fiber with the tin solution. The second is the water to be used after the sodium phosphate treatment. The water employed in these two washing processes is usually of a different character, and rightly so, as will be seen after a consideration of the function it is intended to perform in each case.

The water to be used after the treatment with the tin bath should possess a moderate degree of hardness, for the use in this connection of a water of a very slight degree of hardness has the defect of dissolving the tin salt with the result that less of the tin compound is fixed within the fiber. Also excessive precipitation subsequently of tin hydroxide in the wash water has the effect of throwing some loosely held tin compound on the surface of the fiber.

On the other hand if the water used has too great a degree of hardness a turbidity will be produced from the combination of the tin salt with the lime or magnesia of the water. The most suitable water for this purpose is perhaps one possessing about fifty to one hundred parts per million of hardness. Not only is the degree of hardness to be considered, however, but also the form in which this hardness exists in the water. Temporary hardness, due to bicarbonates, is to be preferred to permanent hardness, due to sulphates or chlorides. Also the hardness due to magnesium compounds is of doubtful value.

The water to be used for washing after the phosphate treatment, on the other hand, should be as free from hardness as possible. It is usually necessary to soften chemically the water for this purpose, and the lime-soda method of treatment is quite generally employed. By this treatment the bicarbonate compounds of lime and magnesia are completely removed from the water, and also through the action of the soda the permanent hardness is also removed, a corresponding amount of sodium salts taking the place of the lime and magnesium compounds in the water. Water softened by this process can usually be reduced to about twenty-five parts per million of hardness.

If one wishes to obtain a water of even greater softness than this it will be necessary to use the zeolite method of treatment, whereby a water of as low as zero degrees of hardness may be obtained. On this account this process is being used more and more in silk weighting establishments, as the benefit from the use of such well softened water is quite pronounced. The advantages of using water of such a low degree of hardness are that the sodium phosphate bath is more readily maintained in a state of purity and uniformity; there is less loss of phosphate, and the luster and good quality of the silk is better preserved.

If water of any appreciable hardness is used in con-

nection with the phosphate treatment a turbidity is produced by the formation of calcium and magnesium phosphates and these become absorbed more or less by the silk and cause it to become cloudy and dull in appearance.—E. Cagliostro, in Dyer & Calico Printer.

A. C. S. DYE DIVISION TO HAVE SYMPOSIUM ON U. S. INDUSTRY PRIOR TO 1914

So much has been said about our synthetic dye industry and its very remarkable growth since the World War, that we are apt to pass over the truly interesting and worth while accomplishment of those who pioneered.

The Dye Division of the American Chemical Society has arranged a symposium for the society's spring meeting in New Haven, Conn. (April 3 to 7, 1923), on which occasion the early accomplishments will be discussed. Those in charge want to hear about the failures and disappointments of the early years, as these ups and downs cannot but be of help to those who are guiding the dye industry.

The aim is to have the papers read at this symposium, and the discussion, so complete that an accurate and full account of this work may become a matter of record. Accordingly, Secretary R. Norris Shreve requests that anyone who knows of the facts pertaining to the manufacture of artificial dyes in the United States prior to 1914, communicate with him at 342 Madison Avenue, New York City.

UNDERWEAR LEAGUE SELECTS STANDARD COLORS

Colors selected by the United Underwear League of America for the Textile Color Card Association, as standards for the underwear trade, are as follows:

White	S.1001	Standard Card
Pink	S.2105	Standard Card
Primrose	S.1403	Standard Card
Light Blue 4	S.6109	Standard Card
Spray	S.1653	Standard Card
Sweet Pea	O.7101	Spring 1921
Roseleaf	O.1234	Fall 1921
Cherub	O.1232	Spring 1922

COTTON FINISHERS PUBLISH STANDARD COLOR CLASSIFICATION

The National Association of Finishers of Cotton Fabrics has published in book form a standard classification of all the colors appearing on the Standard and Season Color Cards issued by the Textile Color Card Association of the United States, Inc. This classification has been arranged for the benefit of the cotton industry and compiled by a committee appointed by the National Association of Finishers, in the interests of Standardization. It denotes the strength of each color according to light, medium or dark and an index is also arranged, which conforms in detail to our new Color Index, listing color names in alphabetical order, color numbers in numerical sequence and cable numbers in consecutive order. There is likewise offered a classification from the standpoint of the silk dyer, thus giving two distinct classifications for cotton and silk respectively.

The committee appointed by the National Association of Finishers to make the classification, offers it in the belief that "its universal adoption will make for greater standardization in the trade and will obviate many discussions as to the classification of various colors."

As each Season Card of the Association is issued, the colors will be classified by the National Association of Finishers and their book will be kept up to date. Any members, who are not affiliated with the National Association of Finishers of Cotton Fabrics, can secure copies of this classification, if desired, by applying directly to their headquarters, at 320 Broadway, New York City.

STANDARD KNITTED OUTERWEAR COLORS ADOPTED

The National Knitted Outerwear Association has adopted as standards for the industry the following forty colors from the Standard Color Card of America:

	Cable No.		Cable No.
Ivory	2	Silver	59
Cream	3	Steel	61
Light Blue 4	26	Strawberry	35
Pink	15	Taupe	65
Turquoise	6	Ecru	29
Orchid	42	Beaver	31
Ocean Green	8	Chestnut	32
Golden Rod	51	Seal	33
Geranium	18	Tan	80
Cardinal	20	Brown	82
Dark Cardinal	21	Burnt Orange	53

	Cable No.		Cable No.
Maroon	032	Terra Cotta	54
Peacock	92	Emerald	36
Gold	86	Myrtle	38
Violet	100	Old Gold	87
Purple	102	Sapphire	41
Copenhagen	56	Orange	52
Yale Blue	72	Fuchsia	96
Marine	73	Bottle Green	98
Navy 2	75	American Beauty	91

The National Knitted Outerwear Association has issued a color card portraying these colors in yarn. Each color has the name and number, with printed statement relative to its selection from the Standard Card issued by the Textile Color Card Association. Mention is given that this has been done in order to maintain color har-

mony between industries and to afford accurate matching of trimmings and findings in the production of knitted garments.

To make the cards as helpful as possible, the chemical formula for the dyeing of each color is given, also a comprehensive explanation as to different methods of dyeing. A list of the colors is also arranged with a classification giving the resistance of each color to light, washing, perspiration and rubbing.

PAPER INDUSTRIES EXPOSITION AT GRAND CENTRAL PALACE IN APRIL

In the Paper Industries Exposition, to be held during the week of April 9 to 14, at Grand Central Palace, New York, while the American Paper and Pulp Association and its related associations are meeting, three main groups will feature the list of exhibits at the exposition as part of the general program which provides for the telling of the whole story of paper, from the forest to the ultimate consumer, to the American public.

Although there will be no rigid rules for the placing of exhibits in sections, there will be, as indicated by the manner in which exhibitors are already contracting for space, some classification of exhibits. These will be arranged in a general way according to the three chief steps in the progress of manufacture and distribution, the first being the paper making machinery and the chemicals entering into the manufacture of paper. The second will be the making of paper itself, and the third the conversion of paper into its various subdivisions in which it reaches the public, such as boxes, twine, and specialties, as well as the large field of distribution to printer and consumer in the form of writing paper and other papers.

DU PONT ANNOUNCES PONTAMINE FAST BLUE RW AND PONTAMINE DIAZO RED 7BL

The du Pont company has prepared a new Direct Blue of great brightness and of good fastness, especially when aftertreated, which it designates Pontamine Fast Blue RW.

It is a color which dyes very evenly in light shades and makes it adaptable for all classes of cotton goods, especially for piece dyeing in the padder. Pontamine Fast Blue RW is said to be one of the best direct blues for dyeing cotton and wool unions, both fibers being dyed the same shade and depth. It is very suitable for dyeing artificial silk as well as wood chip, jute, etc. The product discharges very readily with sulphoxylates. An aftertreatment of copper and chrome and acetic acid makes the shade greener, but at the same time the fastness to washing and light, water and perspiration is materially improved.

The company also announces placing on the market Pontamine Diazo Red 7BL as an addition to its line of diazotizable colors. The product is particularly suited for reds and clarets on ginghams and other washable fabrics, because of its resistance to light and washing.

It may also be dyed on raw stock, yarns, warps, and pieces. It dyes evenly, and is readily soluble, being therefore suitable for machine dyeing. On linen and half linen, as well as on half silk, very brilliant shades are obtained. Pure silk is dyed from an acetic acid broken soap bath, being subsequently diazotized and developed in the usual manner, producing colors fast to water. The shades obtained are readily dischargeable with sulphoxylates.

NOTES OF THE TRADE

The Charex Chemical Company, Rochester, N. Y., has been incorporated with a capital of $25,000. The incorporators are H. M. and H. C. Williamson. The company is represented by Charles E. Bostwick, Insurance Building, Rochester.

The Beacon Color & Chemical Company, 38 India Street, Boston, Mass., has filed notice of organization to manufacture dyes, chemicals, etc. The company is headed by Edward J. Feeley and Frazier L. O. Leary.

The North-Hudson Color & Chemical Company, Union, N. J., has increased its capital stock from $100,000 to $200,000.

The United Indigo & Chemical Company, Ltd., Manchester, England, has issued its annual report to the shareholders, showing a net profit for the year of £36,318-17-1, from which it has declared a dividend of 5 per cent on the ordinary shares, 7½ per cent on the preference shares and further dividends of 7½ per cent on the ordinary shares.

The capital stock of the Reynold Terrell Silk Company, Phillipsburg, N. J., has been increased from $125,000 to $500,000, composed of five hundred shares at $100 per share.

The Corticelli Silk Company has increased its capital from $3,250,000 to $5,750,000, composed of 50,000 shares of common stock, par value $100, and 15,000 shares of preferred, par value $50.

The imports into East Africa of cotton goods manufactured in the United States declined from 23 per cent of the total in 1913 to 8 per cent in 1921. During the same period the increase of imports from India rose from 14 per cent to 40 per cent of the total. It is reported that the appointment of an Indian trade commissioner in this colony has been the means of increasing the sales of cotton piece goods from India.

The Universal Textile Corporation has been incorporated to manufacture and sell silk, with $9,500,000 capital, at Wilmington, Del., through the Corporation Trust Company of America.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
Directing Editor

LAURANCE T. CLARK
Managing Editor

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Vol. XII February 12, 1923 No. 4

OSTWALD'S GIFT

SIR WILLIAM HENRY PERKIN will go down in chemical history as the father of the aniline dye industry; his claim to that distinction is secure for all time.

Since the first mauve of Perkin was produced, many distinguished names have been added to the list of contributors to the advancement of that which Sir William initiated—names which will be remembered and mentioned long after their owners have passed out of existence.

Among these names, that of Dr. Wilhelm Ostwald has for many years stood high. As an educator of rare ability, and as an original investigator of brilliant attainments, his bequests to this most complex of sciences will be recorded as numerous and vital. Yet of all his gifts it is doubtful if any to date will transcend, in actual practical benefit to those who make and those who use dyestuffs, his accurate and workable method of expressing color in mathematical terms.

It should do more to bring order out of the present chromatic chaos than any previous attempt has done. It accomplishes for the entire range of perceptible color what the Standard Color Card of America essays in a limited—though adequate—manner for the ultimate consumer. It is yet too early to predict with certainty its general adoption by the color using world; but it is not too early to say that failure by Americans to investigate its advantages would be sheer stupidity. When this is done, it would appear that its adoption here and on the Continent must follow almost as a matter of course.

Its application will probably not extend clear through to the purchaser of apparel. For that there is no need; the range of choice provided by the Color Card is more than ample to satisfy even the ultra-fashionable woman—and what woman, pray, is not?—for a period of six months. But to the great army of color users, to the textile manufacturers in particular, and to the makers and users of printing inks, papers, leathers, etc., it should be invaluable for the reasons that it is wholly accurate, bringing, as it does, the human factor in matching down to the irreducible minimum; that it is universal, embracing all variations of color perceptible to the eye; that it is simple, requiring only the use of inexpensive apparatus which those of limited experience can operate; and that it is entirely practicable.

Once let it be thoroughly understood, for instance, that with merely a list of numerical symbols a dyer can reproduce any color on the Standard Card without having the card itself before him; or that a perfect match can be made by telephone or telegraph in cities thousands of miles apart; or that failure to provide a perfect match can be conclusively proved in court—and we believe the Ostwald method will be "sold" to the industry. It scarcely seems possible that, after years spent in working it out, its originator could have failed to provide against every possible obstacle to its practical application.

The Standard Color Card contains some seventy or eighty hues, and, as before stated, is a wonderful convenience for the woman who can order by telephone some "Golden Glow" ribbon, let us say, with which to trim a hat of that official color. But the dyer, in order to secure equal convenience in his work, must have a means at his disposal which enables him to express anything whatever among the thousands of possible hues. This convenience is apparently now provided by Ostwald.

Where the dyer is concerned, the dyed samples on the Color Card may in future just as well be left off so far as their necessity, for checking up the match, exists. They will merely be of interest for purposes of selection. Even as it is, if he chooses, for example, to use National dyes, his recipes for producing any color shown on the official Card can be secured ready-made. Likewise, our enterprising American manufacturers will gladly show him how to match any other with the use of their own dyes.

The Ostwald method, however, should eliminate much lost time and waste motion in connection with this essential service. If the colorist has trouble in producing 05-15t-10b-75w on silk, wool, paper or what not, he can avoid delay by wiring the plant laboratory, where the manufacturer's own colorists can set to work within the hour, wiring back the dyeing formula with supplementary instructions without ever having seen the dyed sample to be matched. The client of the dyeing plant, on the other hand, can be more sure than ever before—because of the increased accuracy with which the colorist can check his own work—that when his goods are delivered they will be correct in shade to a point beyond the ability of the unaided human eye to detect.

All readers of The Reporter are urged to peruse

carefully H. T. Tenen's article, which heads this issue. In it the author gives an excellent, detailed exposition of the Ostwald method of mathematical color measurement, and while the subject is not one which concerns the work of to-day or this week, it is nevertheless of immediate, practical interest, for it will soon be up to the industry to make a decision as to the adoption or rejection of this method.

We take pleasure in presenting the description and would counsel all to acquaint themselves with the details of the Ostwald system. We believe, further, that it would be of benefit if readers will express themselves freely regarding it.

"A TEST CASE"

ELSEWHERE in this issue a news item will be found relative to the decision by the U. S. Appraiser for the Port of New York that a product known as Pyrazolon offered for import by a prominent Swiss manufacturer is held to be competitive with a similar product manufactured by an American concern in the course of its production of Fast Light Yellow. Pyrazolon is in reality a dye base, being a combination of various intermediates and requiring only a simple coupling operation to convert it into Fast Light Yellow.

This decision is of wide importance to American dyestuff manufacturers because of the fact that there are any number of other semi-finished products which although possibly not competitive, in themselves, with American-made products which are freely offered in our markets may, nevertheless, be transferred by minor chemical operations into finished products which are directly competitive with similar products made in this country.

Inasmuch as the expressed intent of the present tariff law is to protect the American dyestuff industry and as the law, moreover, provides that in cases where doubt exists the higher rate of duty shall apply, it would seem that this decision is quite in accord with both the spirit and the letter of the law.

Were 90 per cent completed products of foreign manufacture, as in the above case, to be admitted as non-competitive in instances where the finished products themselves were admittedly competitive, a very obvious threat to the American dyestuff mnufacturing industry and a violation of the intent of the present tariff law would be evident.

THE NEW A. C. S. PRESIDENT

DR. EDWARD C. FRANKLIN, Professor of Organic Chemistry of Leland Stanford Junior University, who has been elected President of the American Chemical Society, succeeding Dr. Edgar F. Smith of the University of Pennsylvania, was born at Geary City, Kan., in 1862. He was graduated from the University of Kansas in 1888 and received his master's degree in 1890. He was a student at the University of Berlin in 1890-91; he received the degree of Doctor of Philosophy at Johns Hopkins University in 1894.

He was a member of the Advisory Board of the U. S. Bureau of Mines in 1917-18; physical chemist of the U. S. Bureau of Standards and consulting chemist of the Ordnance Bureau of the Army during the war. Dr. Franklin's work on liquid ammonia as an electrolitic solvent is familiar to all chemists. In addition to his university work he also was in industrial work for a number of years, serving in the sugar industry and also in the gold mining industry. In the latter work he was stationed at Miramar, Costa Rica, in 1897.

Dr. Franklin was chosen from among the four nominees for President of the Society who received the largest number of votes. The ballots were sent in by mail from the various members of the Society. The choice among these four was determined by a vote of the Society. The three other leading candidates were Dr. James F. Norris of Massachusetts Institute of Technology, Samuel S. Parr of the University of Illinois, and Dr. Charles L. Reece, Chemical Director of E. I. du Pont de Nemours & Co., of Wilmington, Del.

To the new President of this vital organization, The REPORTER extends its customary greetings, coupled with best wishes for a term of service which will further brighten the luster surrounding the work of the American chemist in thought and industry of to-day.

STANDARD CONVEYOR BUYS OUT BROWN PORTABLE; WILL OPERATE PLANT

The Standard Conveyor Company announces that it has acquired by purchase all the rights, titles and patents pertaining to the well-known "Brown Portable" line of portable and sectional piling, elevating, conveying, loading and unloading machinery for the handling of packed and loose materials.

This line of machinery has been manufactured by the Brown Portable Conveying Machinery Company, at North Chicago, for ten years. Until further notice the plant will be continued in operation by the Standard Conveyor Company, and all inquiries and correspondence regard "Brown Portable" products should be addressed to Standard Conveyor Company, "Brown Portable" Products Plant, North Chicago, Ill.

The firm also states that the organization which has so successfully developed portable conveying machinery, known the world over as the "Brown Portable" products for their merit, will continue with the Standard Conveyor Company in this line of work, in which they are the originators.

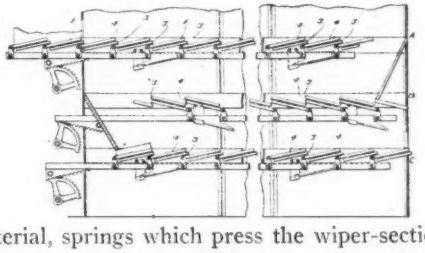
The Adenzit Company, Long Island City, N. Y., has been incorporated with a capital of $15,000, to manufacture chemicals, dyes, colors, etc. The incorporators are W. C. and I. W. Kober, and T. Moore. The company is represented by J. K. Gillette, 424 Stein Avenue, Long Island City.

Recent Patents

Drier for Textile Stock, Etc.

U. S. 1,428,290; September 5, 1922. Mathew F. Kelvin, Springfield, Vt.

This describes a drier, for loose stock, having a feeding and supporting platform comprising a plurality of fixed and movable shelves or tables, alternated, said shelves or tables each having mounted in connection therewith wiper-means for coaction with the next adjoining shelf or table, such wiper-means comprising an alined series of wiper-sections having wiping surfaces of flex-

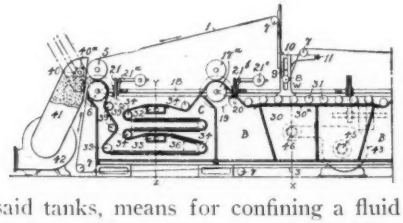


ible material, springs which press the wiper-sections into contact with the surface which they wipe, and clips applied to a shelf or table, retaining the corresponding wiper-section in working connection therewith, and preventing accidental disconnection of the wiper-sections from the shelf or table when the latter is disassembled.

Apparatus for the Dyeing and Other Treatment of Textile Fibers in the Loose State

U. S. 1,432,319; October 17, 1922. John Brandwood, Thomas Brandwood, and Joseph Brandwood, Elton, Bury, England (see preceding).

Apparatus for treating textile material in the loose state before spinning, comprising tanks, perforated mem-



bers in said tanks, means for confining a fluid adjacent to said perforated members, means for holding and traversing the material to be treated in contact with said perforated members, and means for causing a fluid confined within said confining means to pass forcibly through the material and through the perforations of said members.

Dyes

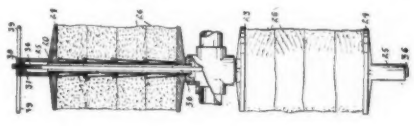
British 181,304; November 27, 1920. A. H. Davies, R. F. Thomson, J. Thomas, and Scottish Dyes, Ltd., Murrell Hill Works, Carlisle.

States that a vat-dye giving greenish-blue shades on cotton is obtained by treating the oxidation product of dibenzanthrone with dimethyl sulphate. The product may be purified by crystallization from nitrobenzene, or by treating with sodium chlorate and hydrochloric acid solution, or by forming and dissociating its sulphate; it appears to be a dimethoxydibenzanthrone.

Dyeing Machine for Worsted Tops, Yarns, Etc.

U. S. 1,442,419; January 16, 1922. Harry G. Ashworth and Asa Ashworth, Salamanca, N. Y.; assignors to International Textile Devices, Inc., Salamanca, N. Y.

This describes, in a drying device, in combination with a source of air supply, a feed pipe for said air, tubular



perforated spindles attached horizzontally in opposite pairs to said feed pipe to balance one another, said spindles being adapted to receive worsted tops on perforate spools, means for clamping said worsted tops on said spindles to force said air through said tops to dry the same, and gate valves between said pairs of tubular perforated spindles to control the size of the drying machine.

Foreign Trade Opportunities

Reserved information may be obtained from the U. S. Bureau of Foreign and Domestic Commerce and its district and co-operative offices by duly registered firms and individuals upon written request by opportunity number. The Bureau does not furnish credit ratings or assume responsibility as to the standing of foreign inquirers; the usual precautions should be taken in all cases, and where no references are offered it does not necessarily imply that satisfactory references could dnot be given. Correspondence may be in English unless otherwise stated. Symbols: *Reported by American consular officers; †Reported by commercial attaches and trade commissioners; ‡Direct inquiries received by the Bureau.

4978.*—Women's *silk, wool* and *cotton hosiery*—Spain. Agency. Quotations, c. i. f. Spanish port.

4981.*—Dry goods, waterproof cloth, *shirtings,* and waterproof wind cloth—Norway. Agency.

4993.*—Automobiles, agricultural machinery, typewriters, steel rails, *calicoes* and novelties—Serbia. Agency. Payment: Cash.

5509.†—*White and gray sheetings, voiles, brins* and *fancy textiles*—Argentina. Purchase. Quotations, c. i. f. Argentine port. Terms: Cash against documents in the United States.

5020.†—Motion-picture films, flour, *textiles* and paper —Brazil. Agency.

5027.*—*Cotton fabrics* of all classes, generally of medium gradeds, particularly *unbleached sheeting* and *prints;* tea (English preference), yellow corn, soft wheat, flour, sugar and other foodstuffs—Azores. Purchase. Quotations, f. o. b. New York. Terms: Cash with order.

5038.*—Men's overalls, jumpers, waterproof raincoats; *cotton, silk* and *wool bathing suits; shirts;* gaiters; *cotton, silk* and *wool pajamas;* and other wearing apparel—Netherlands. Agency. Quotations, c. i. f. Rotterdam or Amsterdam.

5057.†—Wood chemicals, heavy chemicals, *tanning materials,* and carbon black—England. Agency. Quotations, c. i. f. English port.

4930.*—*Silk hosiery*—Denmark. Agency from manufacturer.

4935.‡—Soda and *chemicals for* the paper, leather and *textile industries,* and rosin, turpentine, gums and waxes —India. Agency. Quotations, c. i. f. Calcutta. Terms: Cash against documents.

4940.*—*Wool, raw cotton,* upper leather and fresh apples—Norway. Agency.

4941.‡—*Cotton textiles,* including *underwear* and *hosiery*—Argentina. Agency. Quotations, c. i. f. Buenos Aires.

4944.*—Wheat, coffee, dried and fresh fruit, rice, flour, syrup, pure lard, short clear middles, casings, grain, feedstuffs and *cotton*—Sweden. Agency. Quotations, c. i. f. Swedish port. Terms: Cash against documents.

4960.*—*Men's hosiery,* shirts, sweaters, handkerchiefs, playing cards, lanterns, wicks, globes, stationery, locks, etc.—India. Agency or purchase. Quotations, c. i. f. Calcutta.

4963.*—*Woolen goods* for summer wear—South Africa. Purchase from manufacturers. Quotations, c. i. f. Durban.

NEW SOCIETY LAUNCHED TO BOOST CHEMIST'S PROFESSIONAL STANDING

Announcement has been made that the American Institute of chemistry was organized at a meeting of local New York chemists, at 381 Fourth Avenue, that city, on January 22. This new society, it is stated, aims to include only chemically trained men who measure up by education and experience to the qualifications set for membership.

It will function along the same lines as the Institute of Chemistry of Great Britain and the Canadian Institute of Chemistry, which have been successful in giving to the vocation of chemistry a professional status by recognizing only those as entitled to be called chemists who satisfy certain standards of capacity.

The American Institute of Chemistry will seek to perform for the qualified chemist the same service as that of the Bar Association for the lawyer and of the Medical Society for the physician.

Dr. H. G. Byers, in charge of the Department of Chemistry of Cooper Union, and Dr. Lloyd Van Doren, a chemical patent lawyer, both Johns Hopkins graduates, are respectively president and vice-president. C. K. Simon, president of the Dye Products & Chemical Company, 200 Fifth Avenue, New York, is treasurer. The secretary is Lloyd Lamborn, editor of Chemical Age.

CAMPBELL ANNOUNCES AMALTHION (SULPHUR) GREEN 4GY

John Campbell & Co., 75 Hudson Street, New York, has announced that this firm is now manufacturing Amalthion (Sulphur) Green 4GY which is equal in shade, strength and working properties to Pyrogene Green 3G, Thional Green, and others.

One of the brightest, yellowest greens on the American market to-day, this product is fast to light and fulling, stands cross dyeing, is suitable for printing, and is recommended for raw stock, skein, and piece dyeing. The company will furnish product samples upon request.

O. B. HESS TO REPRESENT ATTEAUX IN PHILADELPHIA

O. B. Hess, some time past with the Ciba Company as leather expert, has become associated with F. E. Atteaux & Co., and will operate from the Philadelphia office of that corporation.

W. J. Barr, for many years with Atteaux & Co. in Philadelphia, will continue to serve the interests of the company in the textile field.

PHARMA UPHELD

A decision rendered by the U. S. Appraiser of Merchandise for the Port of New York on January 29 holds that a shipment of Pyrazolon imported by the Sandoz Chemical Works is competitive with a similar product manufactured by the Pharma Chemical Corporation and that the basis of the appraisement of this shipment is the American selling price at which the Pharma Chemical Corporation is offering Pyrazolon for sale in this country.

Pyrazolon is the product from which Fast Light Yellow is made, it being in reality a combination of intermediates and requiring only a simple coupling operation to produce the finished product.

Italian Dye Consumers Claim Damages for Diluted Reparation Colors

By RAFFAELE SANSONE

Genoa, January 8, 1923.
Special to The Reporter.

THE importation of dyestuffs was greatly facilitated during December by further gains of the Italian lira, which brought the U. S. dollar from 20 lire to 19.50 lire; the English pound sterling from 91.10 lire to 88 lire, and the French franc from 1.40 lire to 1.30 lire, the German mark remaining between 0.30 lira and 0.20 lira.

Some of the Reparation colors delivered, through insufficient control at the pont of origin, were found to be strongly diluted, resulting in claims for damages on the part of the consumers. Through the Versailles treaty Italy is the nation that has received the greatest quantity of synthetic Reparation dyestuffs from Germany; these products reaching, until June 30, 1922, 12,713,000 gold marks on a total delivery of 43,184,000. Italy thus received about 33 per cent, against 25 per cent sent to France, 22 per cent to England, 14 per cent to Belgium, 6 per cent to Japan.

This placed Italy in the position of exporting a quantity of such coloring matters to America and other countries in competition with the German colors themselves, as stocks of the latter were in excess of the real needs of Italian consumers. It is feared, however, that the new customs tariff placed by the United States on competitive colors will greatly reduce the exportations to that country, rendering more difficult the disposal of such dyestuffs in future.

The demand for colors was very fair on the part of works in Liguria, Lombardy, Veneto, Piedmont and Tuscany, and as usual could only be satisfied in part with the war indemnity products, leaving a large number of orders for private enterprise. The cotton colors mostly demanded were Direct Browns, Direct Blues, Direct Blacks, Chrysophenine, Direct Violets, Direct Oranges, the Ericas, Sulphur Blacks, etc. With wool dyes the demand was still pronounced, especially in the case of Navy Blues, Naphthylamine Blacks, the Peneceaux, Tartrazine, Quinoline Yellow, Chrome colors, Alibarine colors, etc.

Prices of Coal-Tar Dyes

The quotations of Reparation dyes in Table I, per ton in lire and dollars, show the difference produced in the dollars and lire prices at the moment of writing, in comparison with the prices prevailing on November 8 (the dyes being delivered in kegs from 25 to 50 kilos).

Mordants, Assistants, Dyehouse Products

The continued activity of the dye works, despite the lower foreign exchange, brought about a fall in the prices of some of the products, and especially of copper sulphate, acetic acid, hydrochloric acid, alum, caustic soda, white dextrine, farina, industrial castor

TABLE I

	Lire	Dollars	
	November 8	December	January
Naphthol Yellow	40,000—65,000	2,000—3,250	2,051—3,333
Auramine	60,000—70,000	3,000—3,500	3,076—3,589
Orange II	22,000—25,000	1,100—1,250	1,128—1,282
Nigrosine (water soluble)	28,000—35,000	1,400—1,750	1,435—1,794
Nigrosine (soluble in alcohol)	30,000—38,000	1,500—1,900	1,538—1,948
Sulphur Black	6,750— 9,750	337— 487	346— 500
Acid Black	30,000—35,000	1,500—1,750	1,538—1,794
Direct Black	30,000—36,000	1,500—1,800	1,538—1,846
Chrome Black	34,000—38,500	1,700—1,925	1,743—1,974
Methylene Blue	75,000—90,000	3,750—4,500	3,846—4,615
Direct Blue	24,500—28,000	1,225—1,400	1,256—1,435
Sulphur Blue	33,500—38,000	1,675—1,900	1,717—1,948
Malachite Green	75,000—90,000	3,750—4,500	3,846—4,615
Acid Green	60,000—70,000	3,000—3,500	3,076—3,589
Direct Green	41,000—54,500	2,050—2,725	2,102—2,794
Bismarck Brown	35,000—42,000	1,750—2,100	1,794—2,153
Magenta (Fuchsine) Crystals	70,000—80,000	3,500—4,000	3,589—4,103
Eosine	50,000—75,000	2,500—3,750	2,564—3,846
Ponceaux	28,500—35,000	1,425—1,750	1,461—1,794
Methyl Violet	65,000—80,000	3,250—4,000	3,333—4,103

TABLE II

	December		January	
	Lire	Dollars	Lire	Dollars
Acetate of alumina	1,600	80	1,600	82
Chrome alum	3,500	175	3,500	179
Bichromate of potash	5,900	295	5,900	302
Ferrous sulphate	500	25	500	25
Copper sulphate	2,400	120	2,280	117
Tartaric emetic	12,000	600	12,000	615
Aniline oil	13,500	675	13,500	692
White refined glycerine	8,800	440	8,800	451
Glucose (45 deg. Be.)	3,900	195	3,900	200
Hydrogen peroxide	2,100	105	2,100	107
Tannic acid (60 per cent)	20,000	1,000	20,000	1,025
Tartaric acid (crystals)	12,000	600	13,500	692
Acetic acid (30 per cent)	2,290	100	2,200	112
Formic acid	7,500	375	8,500	435
Hydrochloric acid (20-21 deg. Be.)	300	15	250	12
Lactic acid (80 per cent)	6,000	300	6,000	307
Alum	1,000	50	900	46
Ammonia (22 deg. Be.)	1,450	72	1,450	74
Bisulphite of soda (22 deg. Be.)	380	19	380	19
Chlorate of potash	3,200	160	3,200	164
Chloride of ammonia	4,000	200	4,000	205
Bleaching powder	900	45	900	46
Nitrite of soda	2,950	147	2,950	151
Yellow prussiate of potash	22,000	1,100	22,000	1,128
Yellow prussiate of soda	12,900	645	15,000	769
Caustic soda (70/72)	2,100	105	2,000	102
Silicate of soda (140 deg. Tw.)	1,000	50	1,000	51
Sodium sulphide	2,300	115	2,500	128
Logwood extract	8,000	400	8,000	410
Yellow dextrine	3,300	165	2,900	148
White dextrine	3,400	170	2,950	151
Farina	2,550	127	2,050	105
Kordofan gum	8,000	400	8,000	410
Indigo (25 per cent)	23,000	1,150	23,000	1,179
Beta-naphthol	19,000	950	19,000	974
Industrial castor oil	6,750	337	6,500	333

oil, etc. In some cases prices rose through the larger demand. The price of sumac leaves rose, and dealers are still reluctant to make contracts for future deliveries at present prices. In normal times the production of such leaves ranges from 25,000 to 30,000 tons per year.

Some of the lira and dollar quotations are given, per ton at Milan, in Table II, above.

Private Dyehouse Quotations

Some private quotations for dyestuffs at Genoa were as follows, per kilo, showing how these competed against the Reparation products: Direct Black, 32 to 35 lire; Nigrosine Crystals, 26 to 30 lire; Chrome Black in powder, 34.50 to 36 lire; Direct Green, 45 to 50 lire; Eosine, 51 to 75 lire; Orange II, 22 to 26 lire; Methylene Blue, 75 to 90 lire; Liquid Fustic Extract, 8 to 8.50 lire; Logwood Extract, 8 to 8.50 lire; Hematite Crystals, 12 to 13 lire.

CHEMIST WANTED

Thoroughly qualified to manufacture practically Hydrogen Blue and Ethyl Carbazole. Theorists will please not reply. Address Box 221, American Dyestuff Reporter

TECHNICAL CONTROL CHEMIST WANTED

Exceptional opportunity for man thoroughly experienced in practical plant operations and control of Dyes, Intermediates and Chlorinated Products. Sound engineering and resourceful research ability desirable. Address Box 222, American Dyestuff Reporter.

LABORATORY WORK

Wanted by large dyestuff manufacturer, for laboratory work, a man thoroughly familiar with dyestuffs, particularly for printing. Give complete qualifications. Address Box 219, care of the American Dyestuff Reporter.

Established 1895

BOSSON & LANE

Manufacturers of

The Original

BLEACHING OIL

for boiling out Cotton, to produce a foundation for a Pure White

High Grade Sulphonated and Saponified

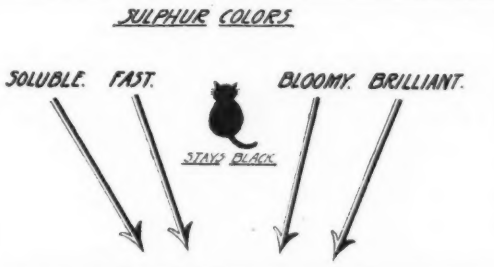
CASTOR OIL PRODUCTS

Para Soap Oil

Solvents and Assistants for cleaning all Textiles

B & L Bleachers' Bluings and Tints

Works and Office, ATLANTIC, MASS.



ATLANTIC PATENT BLACK

ATLANTIC YELLOWS.
ATLANTIC BLUES
ATLANTIC BROWNS.
ATLANTIC MAROONS.
ATLANTIC GREENS.

Economy
Low percentage is required to produce a deep brilliant black.

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Uniformity of atlantic products can be always depended upon

ATLANTIC DYESTUFF COMPANY
Portsmouth N.H.
Newyork Charlotte Chicago Philadelphia Providence

The First Book in the English Language on This Important Branch of the Dyeing Art—

The Principles and Practice of Fur Dressing and Fur Dyeing

By William E. Austin

The transfer of furs from Leipzig, Paris and London to the hands of our domestic dyers found the home industry lacking in accurate information and without one standard work in English to fill this gap in our technical literature.

Technical journals have thus far been unable to cope with the situation, while the only reliable French and German works are unobtainable.

Austin's book, the pioneer in the English language, adequately fills the dual role of text-book and practical handbook for the worker. It can be had from us, postpaid, upon receipt of price.

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